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ABSTRACT

This report contains estimates of hearing levels for children 6 to 11 years of age in the United States as determined in the second cycle of the Health Examination Survey, conducted during 1963-1965. A probability sample (N=7,119) was selected to represent the 24 million children 6 to 11 years of age in the noninstitutional population. Hearing threshold levels for the right ear and left ear of each child examined were determined individually by air conduction with standard pure-tone audiometers at eight frequencies. Testing was done under carefully controlled conditions in a specially constructed trailer. The report gives findings by age and sex for the right ear, left ear and better ear at each of the test frequencies, and also presents estimates of hearing levels for speech. Comparison of the present study findings with findings from some of the previous large-scale hearing surveys, such as the 1935-1936 National Health Survey and the Pittsburgh Surveys, is included. Tables and appendixes comprise two thirds of the document. (Author/NH)

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NATIONAL CENTER For HEALTH STATISTICS | Series 11 Number 102

VITAL and HEALTH STATISTICS

DATA FROM THE NATIONAL HEALTH SURVEY

Hearing Levels of Children by Age and Sex

United States

PS00439

Distribution of hearing levels of children, 6-11 years, by age and sex at frequencies of 250, 500, 1000, 2000, 3000, 4000, 6000, and 8000 cycles per second, for the right ear, left ear, and better ear, as determined from individual air.conduction testing.

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Health Services and Mental Health Administration

Washington, D.C. February 1970

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COOPERATION OF THE BUREAU OF THE CENSUS

In accordance with specifications established by the National Health Survey, the Bureau of the Census, under a contractual agreement, participated in the design and selection of the sample, and carried out the first stage of the field interviewing and certain parts of the statistical processing.

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Series 11 reports present findings from the National Health Examination Survey which obtains data through direct examination, tests, and measurements of samples of the U.S. population. The reports published to date (Nos. 1 through 34) have related to the adult program. Additional reports concerning this group will be forthcoming and will be numbered consecutively, 35, etc. The present report represents one of a large number of reports of findings from the children and youth programs, Cycles II and III of the Health Examination Survey. These reports emanating from the same survey mechanism, will be published in **Series 11 but are numbered consecutively beginning with 101. It is hoped this will facilitate the efforts to provide users with all of the data and only the data in which they are interested.**

THIS REPORT CONTAINS estimates of hearing levels for children 6-11 years of age in the United States as determined in the second cycle of the Health Examination Survey, conducted in 1963-65. A probability sample of 7,417 children were selected to represent the 24 million children 6-11 years of age in the noninstitutional population of the United States. Out of the 7,417 children selected in the sample, 7,119 or 96 percent were examined.

Hearing threshold levels for the right ear and left ear of each child examined were determined individually by air conduction with standard pure-tone audiometers at eight frequencies—250, 500, 1000, 2000, 3000, 4000, 6000, and 8000 cycles per second. Testing was done under carefully controlled conditions, with respect to equipment and acoustical environment, by trained technicians in an acoustically treated room in the specially constructed trailer in the mobile examining center.

The report gives findings by age and sex for the right ear, left ear, and better ear at each of the test frequencies, as well as presenting estimates of hearing levels for speech. These findings are the first to be made available from a nationwide probability sample of children in the United States.

Comparison of the findings from the present study with those from some of the previous large-scale hearing surveys, such as the 1935-36 National Health Survey and the Pittsburgh Surveys, are included.

Hearing threshold levels are expressed in terms of the 1951 American Standards Association's audiometric zero, as they were for the National Health Examination Survey among adults in 1960-62, but the International Organization for Standardization's 1964 ISO recommendation for standard reference zero is also shown.

SYMBOLS

Data not available	---
Category not applicable	...
Quantity zero	-
Quantity more than 0 but less than 0.05	0.0
Figure does not meet standards of reliability or precision	*

HEARING LEVELS OF CHILDREN BY AGE AND SEX

Jean Roberts and Paul Huber, *Division of Health Examination Statistics*

INTRODUCTION

Contained in this report are national estimates of hearing levels for children based on data obtained at eight frequencies by individual air-conduction testing with pure-tone audiometers in the Health Examination Survey of 1963-65.

The Health Examination Survey is one of the major programs of the National Center for Health Statistics, authorized under the National Health Survey Act of 1956 by the 84th Congress as a continuing Public Health Service activity to determine the health status of the population.

Three different survey programs are utilized in the National Health Survey.[1] The Health Interview Survey is concerned primarily with the impact of illness and disability upon the lives and actions of people and the differentials observable in various population groups. It collects information from samples of people by household interview. The Health Records Survey consists of follow-back studies based on vital records, institutional surveys to establish sampling frames as well as provide data, and surveys based on hospital records. The third major program is the Health Examination Survey.

In the Health Examination Survey, data are collected by direct physical examinations, tests, and measurements performed on the population studied. This vehicle provides the best way to obtain actual diagnostic data on the prevalence of certain medically defined illnesses. It is the only reliable way to secure information on unrecognized and undiagnosed conditions and on a variety of physical, physiological, and psychological measures within the population. It also provides demographic and socioeconomic data on the sample population under study.

The Health Examination Survey is conducted as a series of separate programs referred to as "cycles." Each cycle is limited to some specific segment of the U.S. population. In the first cycle data were obtained on the prevalence of certain chronic diseases and on the distribution of various measures and other characteristics in a defined adult population, as previously described.[2,3]

The second program or cycle, on which this report is based, required the selection and examination of a probability sample of the noninstitutionalized children 6-11 years of age in the United States. The examination focused primarily on health factors related to growth and development. It included an examination by a pediatrician and by a dentist, tests administered by a psychologist, and a variety of tests and measurements by a technician. A description of the survey plan, sample design, examination content, and operation of the survey is contained in a previous report.[4]

Field collection operations for this cycle were started in July 1963 and completed in December 1965. Out of the 7,417 children selected in the sample, 7,119 or 96 percent were examined. This national sample is representative of the roughly 24 million noninstitutionalized children 6-11 years of age in the United States with respect to age, sex, race, region, size of place of residence, and change in size of place of residence from 1950 to 1960.

During his single visit, each child was given a standardized examination by the examining team in the mobile units specially designed for

use in the survey. Prior to the examination, information was obtained from the parent of the child. This consisted of demographic and socioeconomic data on household members as well as medical history, behavioral, and related data on the child to be examined. Ancillary data for the child on grade placement, teacher's rating of his behavior and adjustment, and health problems known to the teacher were requested from the school. For verification of the child's age and information related to the child at birth, birth certificates were obtained.

Policies for the testing of hearing and the related examination of the ears, nose, and throat were provided through the Subcommittee on Hearing in Children of the Committee on Conservation of Hearing of the American Academy of Ophthalmology and Otolaryngology, of which Dr. Raymond E. Jordan is Chairman. Members of the subcommittee also made on-site visits to review the ongoing hearing examination. Facilities for the testing of hearing, training of technicians in testing and in instrument calibration, and for acoustical surveys were made available through this group. Dr. Eldon L. Eagles, Executive Director of the Subcommittee, served as principal consultant in the hearing aspects of the survey. Specific guidance on audiometric testing and the training of the technicians in this testing was given by Dr. Leo Doerfler of the University of Pittsburgh. Instrument calibration, background noise level surveys, and specific guidance on environmental control aspects of hearing testing was provided by Mr. Kenneth Stewart through his acoustics laboratory at the University of Pittsburgh. Special training in performing the ear examination was also given the survey staff pediatricians.

HEARING LEVEL MEASUREMENT AND RELATED EXAMINATION

Hearing threshold levels were determined for the right and left ear of each child individually at eight frequencies—250, 500, 1000, 2000, 3000, 4000, 6000, and 8000 cycles per second (cps)—in an acoustically treated room using air-conduction earphones with standard pure-tone audiometers. The related examination of the ear, nose, and throat by the survey staff pediatrician included an evaluation of the condition of the drum, auditory canal, and external ear as well as an inspection of the oral pharynx, tonsils, and nose.

Hearing threshold level, as used in this report, is the lowest intensity of a pure tone produced in the audiometer earphone that is reported as just audible to the ear of the examinee being tested in the specified number of trials. The standard audiometers used in the survey were calibrated in accordance with the 1951 American Standards Association specifications.[5] Hence the zero sound intensity level on the dial of these instruments corresponds to the threshold of hearing for "normal" subjects as determined in the National Health Survey of 1935-36. At that time the voltages were measured on earphones that produced sounds which were, in general, barely audible to persons with no history of otological disease or difficulty in hearing.

The "audiometric zero" or zero point on the audiometer was expressed in terms of the sound pressure levels in decibels (dB) produced by the earphones in a National Bureau of Standards' (NBS) 9-A coupler when the voltages corresponding to this threshold of hearing are applied. This audiometric zero point corresponds to a different sound pressure level for each test frequency. Measurement of hearing level could be made in 5-decibel steps from 100 decibels above to 10 decibels below this audiometric zero point. Since the hearing of children is substantially more sensitive than that of the adults tested in Cycle I of the Health Examination Survey, the audiometers were modified by the insertion of a 30-decibel attenuator so that testing could be done to as low as 40 decibels below audiometeric zero in a stable part of the range of the instrument. This made a corresponding reduction in the upper limit that was possible. The value of the attenuator was later subtracted to obtain the actual readings. The reading in decibels re audiometric zero is 20 times the logarithm to the base 10 of the ratio of the sound pressure at the individual's threshold of audibility (zero sensation level) to the reference sound pressure established for audiometers (audiometric zero). Both sound pressures in this ratio are frequently expressed in decibels re 0.0002 dyne per square centimeter. Findings from the survey are presented in terms of the 1951 American Standard as they were for the adult Health Examination Survey in 1960-62.

The basis for converting these findings to those in terms of the 1964 standard reference zero recommended by the International Organization for Standardization and now under consideration for adoption is given in appendix III.

For the testing, performed by trained technicians, the child was seated with his back to the window in the acoustically treated test room in which the door had been closed (fig. 1). The technician made sure that the child's ears were not obstructed with cotton and that eye glasses, earrings, and chewing gum were removed. For girls, hair was pulled back off the ears. He then placed the earphone opening over the ear canal and made sure that the earphone had a good seal against the child's ear. The red earphone was placed on the right ear, the gray on the left.

Figure 1. Testing hearing of children in Cycle II of the Health Examination Survey.

Before placing the earphones the child was told that once they were placed the child should not touch them, that the sound which would be like whistles or horns that would come from them would be heard in one ear at a time and would get progressively fainter. The child was asked to show when the sound was heard by raising his right or left hand and to raise his hand even though the sound was very faint.

The power on the instrument was on for at least 10 minutes prior to the test. The 4000 cycle tone was introduced to the first ear to be tested at a level of 60 decibels for about 3 seconds. When the child responded, the intensity level was set 10 decibels below the previous stimulus intensity and presented for about 5 seconds. The level of the tone was dropped in 10-decibel steps in this manner until no response was obtained. Then the intensity was raised 5 decibels. If a response was obtained, the intensity was reduced 10 decibels. If no response there, the intensity was raised 5 decibels. The threshold recorded was the lowest dial reading at which 50 percent or more responses were obtained, 2 out of 3 trials or 3 out of 5 trials. Only ascending responses were counted in determining the threshold. The sequence of testing was done in a randomized fashion starting with 4000 cps, then proceeding to 1000, 6000, 500, 2000, 250, 4000, 8000, and 3000. Testing of the ears was alternated starting with the right ear for children with even numbered records and with the left ear for children with odd case numbers (appendix I).

During the hearing test when it became apparent that the child was too fatigued to give reliable responses, the frequencies of 3000 and 8000 cycles per second were omitted. As a result the extent of missing data at these two frequencies for the youngest children (6 and 7 years old) was very large, and the estimates shown for them will be much less reliable than for the others (appendix II).

After the testing the technician indicated on the record what conditions, if any, affected the test such as a cold, ear discharge, defective equipment, earache, behavior, or other. If the technician indicated that because of the condition he felt the hearing test results were unreliable, these results were not used.

A disinfectant was applied to the headband and earphones following each test session.

The technician was trained to avoid rhythmic presentation of signals to the child, to skip to another threshold temporarily so as to avoid a long, drawn out search for a particular threshold, to avoid visual or auditory clues when the tone was presented, and to avoid distracting activity.

Acoustical Environment

Hearing was tested in an acoustically treated room within a specially constructed trailer in the mobile examining center. The inside dimensions of the room measured 84 by 156 by 96 inches. Walls, door, and ceiling consisted of 4-inch thick acoustical panels of heavy steel construction. The room contained incandescent lighting and had continuous but quiet ventilation.

Performance of the room in attenuating external noise was determined by acoustical surveys conducted under normal test conditions periodically throughout the cycle. Sound pressure levels were measured both inside and outside the test area with and without the air-conditioning equipment on and under other conditions of excess noise. When compared with the American Standards Association's maximum allowable sound pressure levels for no masking of the test signals above audiometric zero,[3] the findings (shown in table A) indicate that under normal conditions with the air-conditioning equipment on, the rooms would have provided sufficient attenuation of ambient noise for testing to at least 20 decibels below audiometric zero at all test frequencies. The lowest hearing level for which there would be no masking ranged from 22 decibels below audiometric zero at 250 cycles per second to 28-35 decibels below at 500-2000 cycles and 40 decibels or more below from 3000-8000 cycles. Hence, for all practical purposes only at the 250 cycles frequency could masking due to extraneous noise have produced an ele-

Table A. Acoustical survey[1] of the noise levels[2] in the test room used for audiometry in the Health Examination Survey, 1963-65

Frequency band (cps)	Audiometric test frequency (cps)	Maximum allowable sound pressure for no masking above audiometric zero from 1951 American Standard (dB)[1]	Instrument noise (dB)	Sound pressure level (dB) inside test room	
				All air conditioning off	All air conditioning on
Total----------	-	-	-	44-52	61-68
20-75----------	50	40	14	40-50	61-66
75-150----------	125	40	12	28	38-40
150-300----------	250	40	12	12	17-18
300-600----------	500	40	11	11	12
600-1200----------	750	40			
600-1200----------	1,000	40	11	10-11	11
1200-2400----------	1,500	42			
1200-2400----------	2,000	47	11	12	12
2400-4800----------	3,000	52			
2400-4800----------	4,000	57	12	12	12
4800-10000----------	6,000	62			
4800-10000----------	8,000	67	12	12	13

[1] September 19, 1963, at Poughkeepsie, New York.

[2] Sound pressures in decibels re 0.0002 dyne per cm^2 .

vated rather than a true hearing level for the few children whose hearing levels were unusually low (less than 22 decibels below audiometric zero).

During the cycle it was not always possible to select locations for the examining center that at all times presented an ideal acoustical environment for hearing testing and still met other conditions necessary for the rest of the examination.

Analysis of the findings in the frequencies lower than 2000 cycles gives no real evidence of any noticeable degree of masking from external noise, indicating that the acoustical environment was adequate for testing to these low levels.

Audiometer Calibration and Other Aspects of Quality Control

The audiometers used in this survey to measure hearing acuity were Beltone and Maico instruments—standard electroacoustical generators with air-conduction earphones (receivers) of type TDH-39 with MX-41/AR cushions, providing pure tones of selected frequencies and intensities which cover the major portion of the auditory range, and with a manual device for interrupting the tone.

The audiometers were modified and calibrated at the acoustics laboratory of the University of Pittsburgh to furnish readings in terms of hearing levels in decibels on the National Bureau of Standards' 9-A calibrating coupler relative to the 1951 American Standards Association's audiometric zero at frequencies of 125, 250, 500, 750, 1000, 1500, 2000, 3000, 4000, 6000, and 8000 cycles per second. This audiometric zero (American Standard, 1951) for air-conduction testing is based on findings from the clinical followup to the 1935-36 National Health Survey for that subgroup of persons considered to have "normal" hearing. This subgroup consisted of 1,242 persons, of all ages and both sexes, who gave a history of normal hearing for speech and whose hearing levels (determined by air-conduction tests) for both ears did not exceed a total variation of 15 or 20 decibels on the eight tones from 64 to 8192 cps.[7,8]

The sound pressure levels produced by an audiometric earphone in the NBS 9-A coupler when voltages corresponding to audiometric zero are applied differ for each type and configuration of earphone. The levels for the TDH-39 earphones used in this survey examination, together with the corresponding present international reference zero levels for pure-tone audiometers recommended by the International Organization for Standardization (ISO), are shown in appendix III.

During the cycle, each audiometer was returned to the acoustics laboratory at the University of Pittsburgh for recalibration after each of the 40 stands (locations) of the examinations and also on the few occasions when monitoring and calibration indicated that the instrument was not functioning adequately. Laboratory calibration procedures routinely included tests to determine whether the instruments were within the following American Standards Association Specifications (table B):[5]

1. Frequencies generated by the audiometer within ± 5 percent of the corresponding frequency reading on the instrument.
2. The sound pressure produced by the earphones at each hearing level intensity readings at each frequency not differing from the normal values by more than 4 decibels at frequencies of 2000 cycles or less and by not more than 5 decibels at frequencies above 2000 cycles.
3. The 5-decibel intervals between successive hearing level readings being not less than 3.5 decibels or more than 6.5 decibels.
4. The time required for the test tone to rise to a value within ± 1 decibel of the required sound pressure being not less than 0.1 second and not more than 0.5 seconds.
5. The sound pressure of the fundamental signal being at least 25 decibels above the sound pressure of any harmonic.

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In the field, audiometers were checked by the technician twice each day—once in the morning after the 10-minute warmup period before testing was started and again after testing was completed for the day. In addition, a weekly field sound pressure calibration at set intensity levels was performed using Brüel and Kjaer Precision Sound Level Meters and Artificial Ear Couplers. Reports of the field calibration were sent routinely to the acoustics laboratory for review. The acoustics laboratory also calibrated the field testing equipment periodically.

As indicated previously, each ear was retested at 4000 cps to provide a measure of the reliability of test results. On the average at the various examination locations the difference ranged from 1 to 4 decibels or less than the interval between the test intensities, the magnitude that might be expected in test-retest of normal subjects.

The randomized order of presentation of the frequencies provided a further safeguard against errors in testing.

Table B. Typical audiometer calibration results for Audiometer No. 3566

Instrument frequency (cps)	Actual frequency (cps)[1]	Intensity error (dB)[2]		Second harmonic below fundamental frequence of (dB)[3]		Attenuator[4]	
		Red phone	Gray phone	Red phone	Gray phone	Expected range	Actual interval
250----------	254---	-0.3	-0.5	35+	35+	95-100	4.8
500----------	509---	-1.7	-1.8	35+	35+	90-95	4.8
1000----------	1012---	-0.7	-0.4	35+	35+	85-90	5.1
2000----------	1986---	-2.8	-2.7	31.0	31.0	80-85	5.0
3000----------	3991---	-2.3	-2.2	35+	35+	75-80	5.1
4000----------	3987---	+1.6	+1.7	35+	35+	70-75	4.9
6000----------	5999---	-0.2	+0.8	35+	35+	65-70	5.2
8000----------	7926---	+0.3	+0.6	35+	35+	60-65	4.9
						55-60	5.2
						50-55	4.8
						45-50	5.2
						40-45	4.8
						35-40	5.3
						30-35	4.9
						25-30	5.1
						20-25	5.0
						15-20	5.0
						10-15	-
						5-10	-
						0-5	-
						-5-0	-
						-10--5	-

Actual attenuation of 30 dB pad = 29.2 dB

Line voltage variation: 105-125 = 0.5 dB (ASA tolerance is 2 dB)

Overshoot and undershoot within ASA tolerance limits of ±1dB

Onset time within ASA tolerance limits of .1 to .5 sec.

Decay time within ASA tolerance limits from 20 dB or more within .5 sec.

[1]ASA frequency tolerance ± 5 percent.

[2]ASA intensity tolerance at 250-2000 cps is ±4 dB, at 3000+ ±5 dB. Obtained at hearing level dial readings of 60 dB.

[3]ASA second harmonic tolerance is 25 dB at 500, 1000, 2000, and 4000 cps.

[4]ASA tolerance ±1.5 dB.

FINDINGS

Patterns in Hearing Thresholds

More than 70 percent of the children in the noninstitutionalized population of the United States have, at least for the better ear, hearing thresholds lower (better) than the 1951 American Standard audiometric zero, as determined from the Health Examination Survey in 1963-65. At all frequencies, except 6000 cycles, at least 75 percent of the children were found to have hearing levels lower than this audiometric zero (fig. 2).

Hearing sensitivity among children was found generally, to decrease with the increase in frequency. This pattern, however, is broken at 2000 and 8000 cycles. The median hearing threshold is lower at 2000 cycles than at 500 and 1000 cycles (that is hearing is better at 2000 cycles than at the two lower frequencies) and lower at 8000 cycles than at the other high tones—3000, 4000, and 6000 cycles per second.

Hearing thresholds for the right and left ear of a particular individual tended to be the same

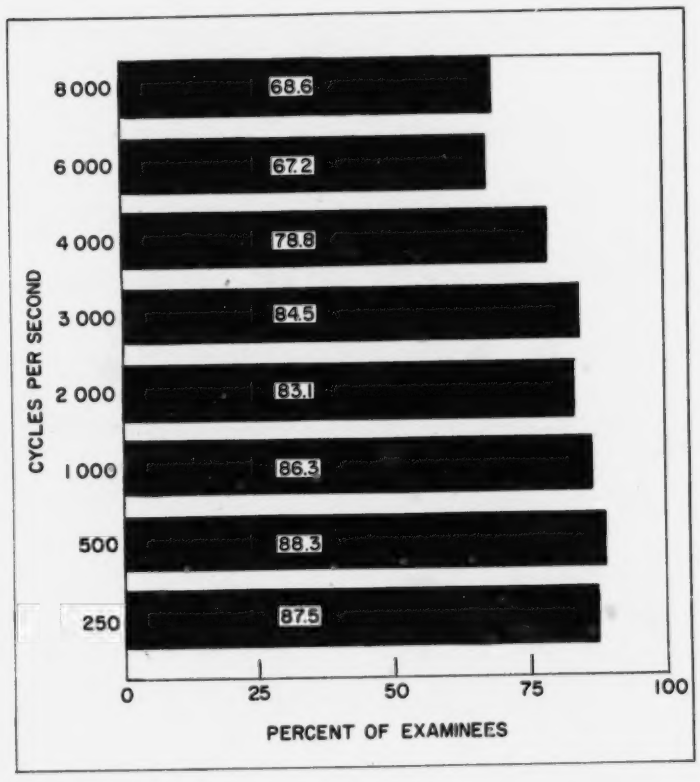

Figure 3. Percent of children 6-11 years with difference in hearing levels between both ears of 5 decibels or less, Health Examination Survey.

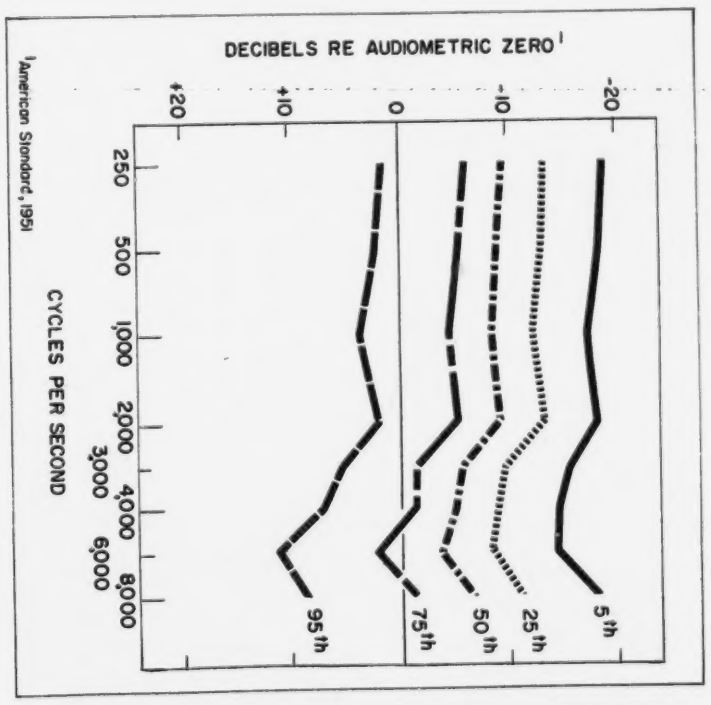

Figure 2. Selected percentiles from the distribution of hearing threshold levels for the better ear of children 6-11 years, at each test frequency, United States.

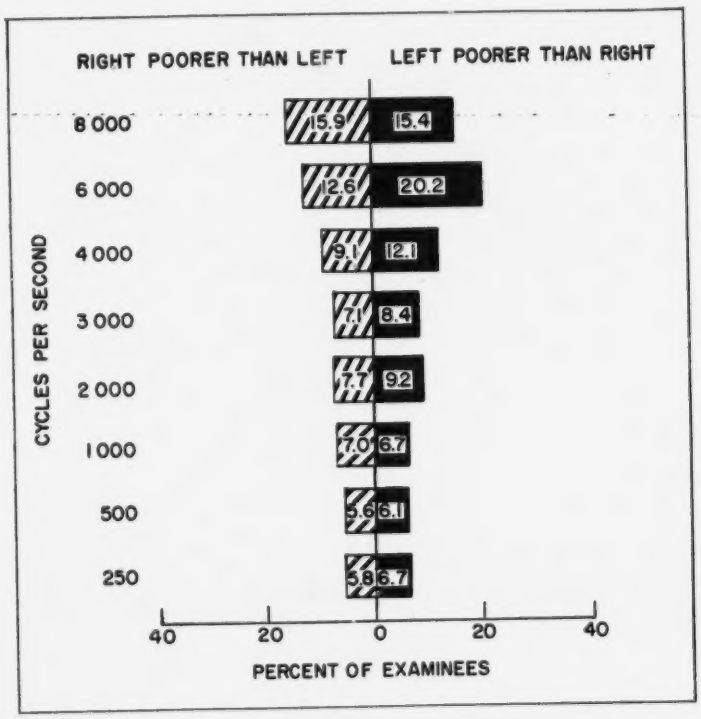

Figure 4. Percent of children 6-11 years with hearing levels in the two ears differing by more than 5 decibels, Health Examination Survey.

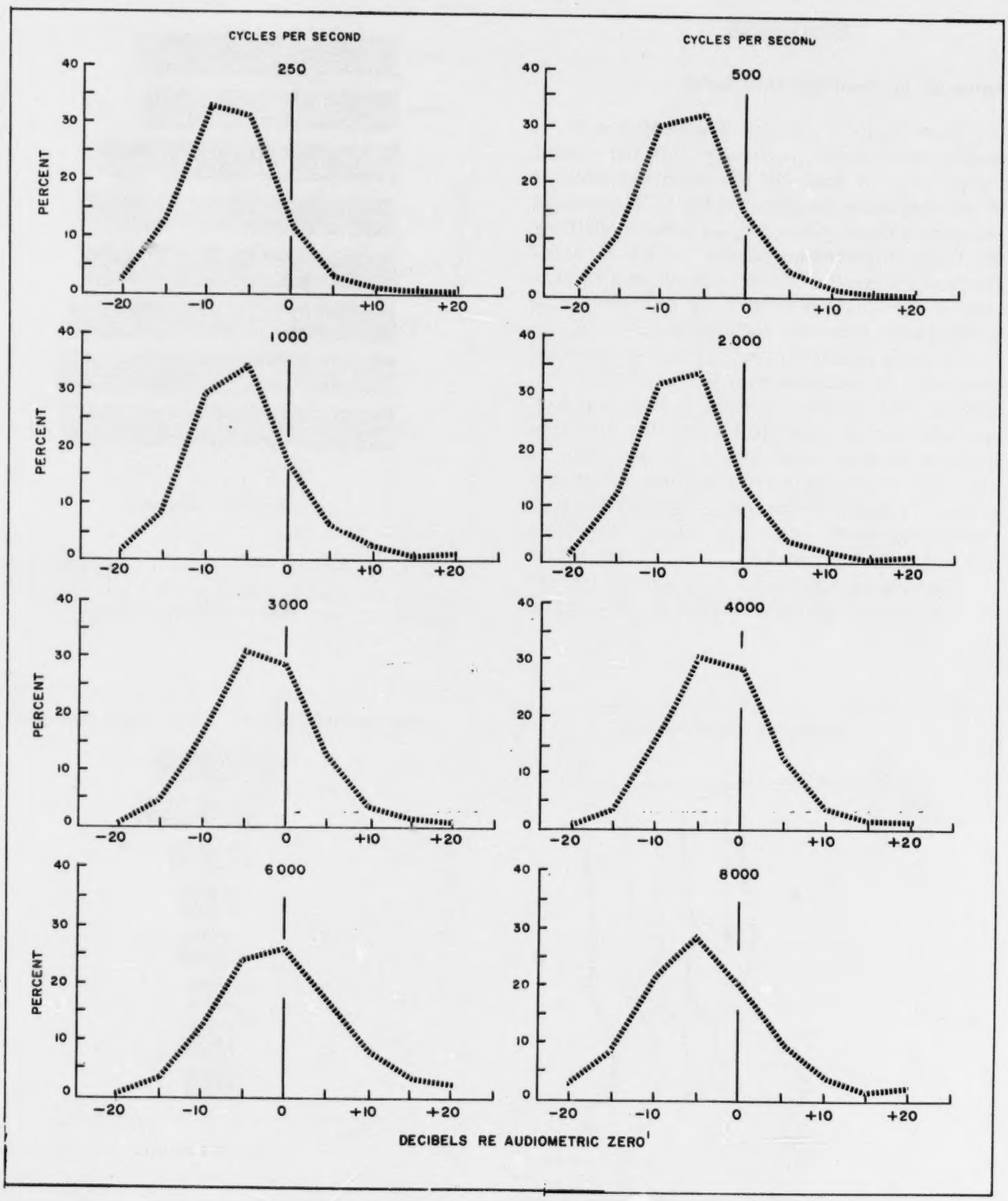

Figure 5. Percent distribution of children 6-11 years, by hearing levels for the better ear at each test frequency, United States.

for most children. The extent of this right-left ear agreement was found to diminish somewhat with the increase in frequency. The highest level of agreement was found at 250 and 500 cycles where for about 88 percent of the children there was no more than 5 decibels difference in test results. The lowest level was at 6000 cycles where for 67 percent of the children there were similar hearing thresholds in the right and left ear (fig. 3).

Where the two ears differ in hearing sensitivity, at most frequencies neither ear is found to be consistently more or less sensitive. At 4000 and 6000 cycles, however, the right ear is found to be more sensitive somewhat more often than the left (fig. 4). The reason for this is not evident, but practice effect during the testing can be ruled out since that potential factor was minimized by alternating the sequence for testing ears from one frequency as well as one examinee to the next.

The distribution of hearing levels is slightly skewed to the right—more skewed for the higher frequencies of 4000-8000 cycles than for the lower frequencies as shown in figure 5 and table 1.

Age and Sex Differences

At all frequencies, there is little difference between the hearing threshold levels of boys and girls, as shown in figures 6 and 7. Although girls are found to have slightly lower (better) median hearing levels at all frequencies except the lowest, 250 cycles, the differences are not statistically significant, being of the order of only a fraction of a decibel (appendix II).

For both sexes, a pattern of increasing hearing sensitivity with increasing age was generally found (tables 2-28). This trend was more marked at the lower frequencies, 2000 cycles or less, as shown in figure 8. At least part of this may be explainable by the behavior of the child, in particular the increasing span of attention with age. It is also possible that at low frequencies, where the trend is most marked, the fit of the earphones is critical and that there may be some earphone leaks in younger children due to the shape of their skulls.

An analysis of seasonal variation, if any, in hearing levels is not presented. These data would not adequately reflect such variation because of operational necessities in the survey which required completion of sample areas in the Northern States during the summer months and areas in the Deep South during the winter.

Estimated Hearing Levels for Speech

Speech-reception thresholds were not measured in the survey examination. However, a frequently used estimate of them is obtained by averaging the levels at the three pure-tone frequencies usually considered most important for understanding speech—500, 1000, and 2000 cycles—for the better ear. This type of estimation procedure is recommended by the American Medical Association's Committee on Medical Rating of Physical Impairment[10] and the American Academy of Ophthalmology and Otolaryngology.[11]

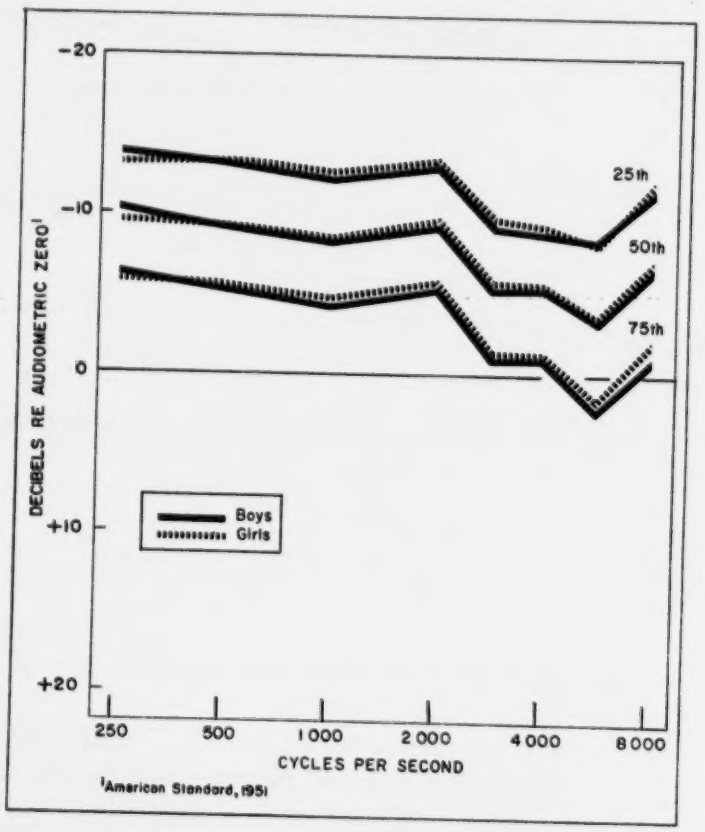

Figure 6. Medians and quartiles (50th, 25th, and 75th percentiles) from the distribution of hearing threshold levels for the better ear of children 6-11 years at selected frequencies, United States.

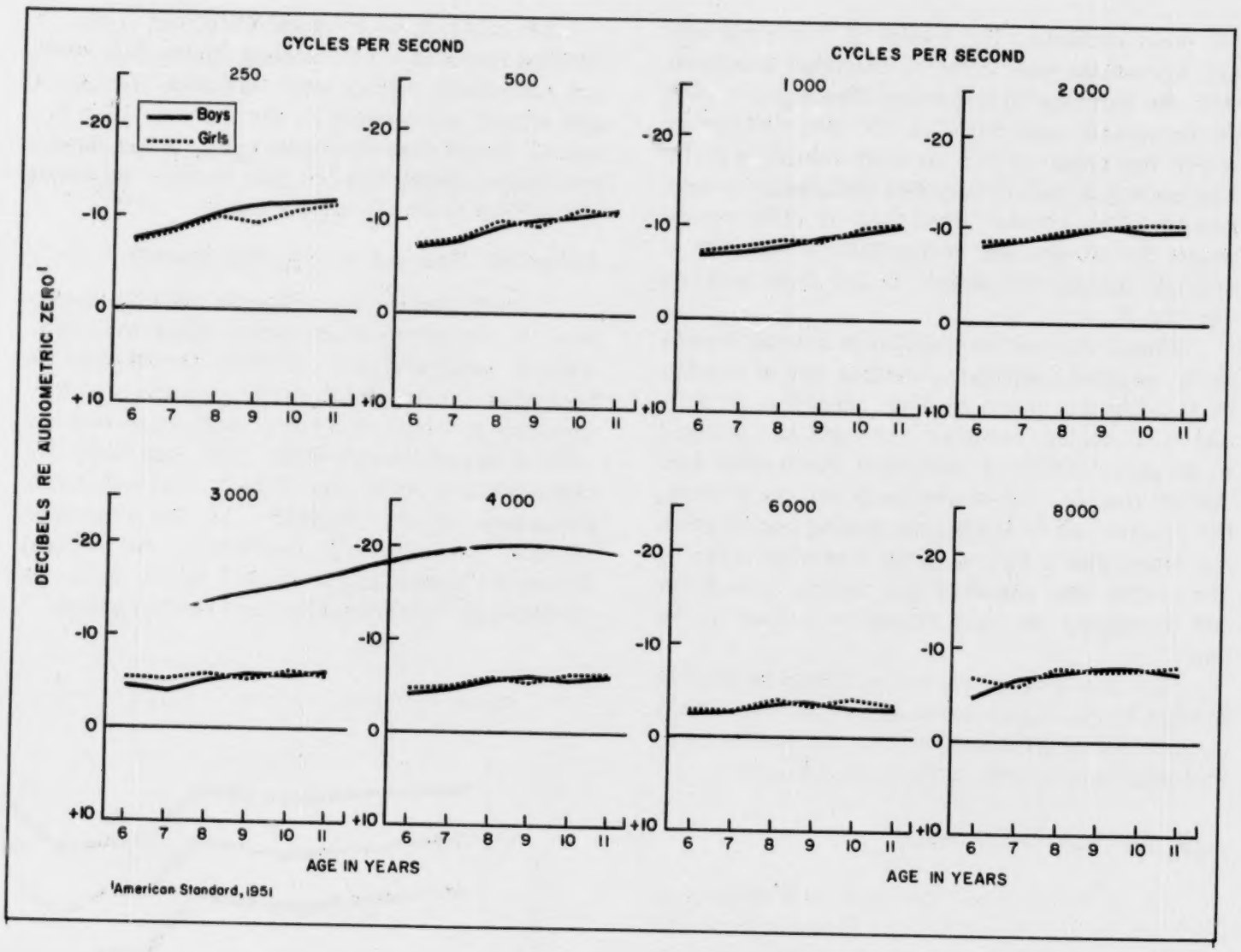

Figure 7. Median hearing levels for the better ear of children, by age at each test frequency, United States.

The distribution of these estimates is shown in table C.

Most of the children in this country were found to have estimated hearing thresholds for speech lower (better) than audiometric zero, as shown in figure 9 and tables 26-28. This threshold for 75 percent of the children was at least 4 decibels below (better) than audiometric zero. As noted previously for the individual frequencies in this range, the hearing thresholds for boys and girls were similar and there was a pattern of increasing sensitivity with increasing age.

The Committee on Conservation of Hearing of the American Academy of Ophthalmology and Otolaryngology has proposed a classification of hearing handicaps for audiometric survey purposes which contains approximate gradations of impairment that are related solely to pure-tone audiometric measurements. These gradations are not related to medical diagnosis and also delib-

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erately disregard the numerous other types of difficulties in understanding speech [12] (table C).

The prevalence of hearing handicaps seen in these terms among children in this country was found to be very low. Less than 1 percent, or approximately 213,000 children 6-11 years of age, have hearing levels of 15 decibels or more above audiometric zero within the critical speech range.

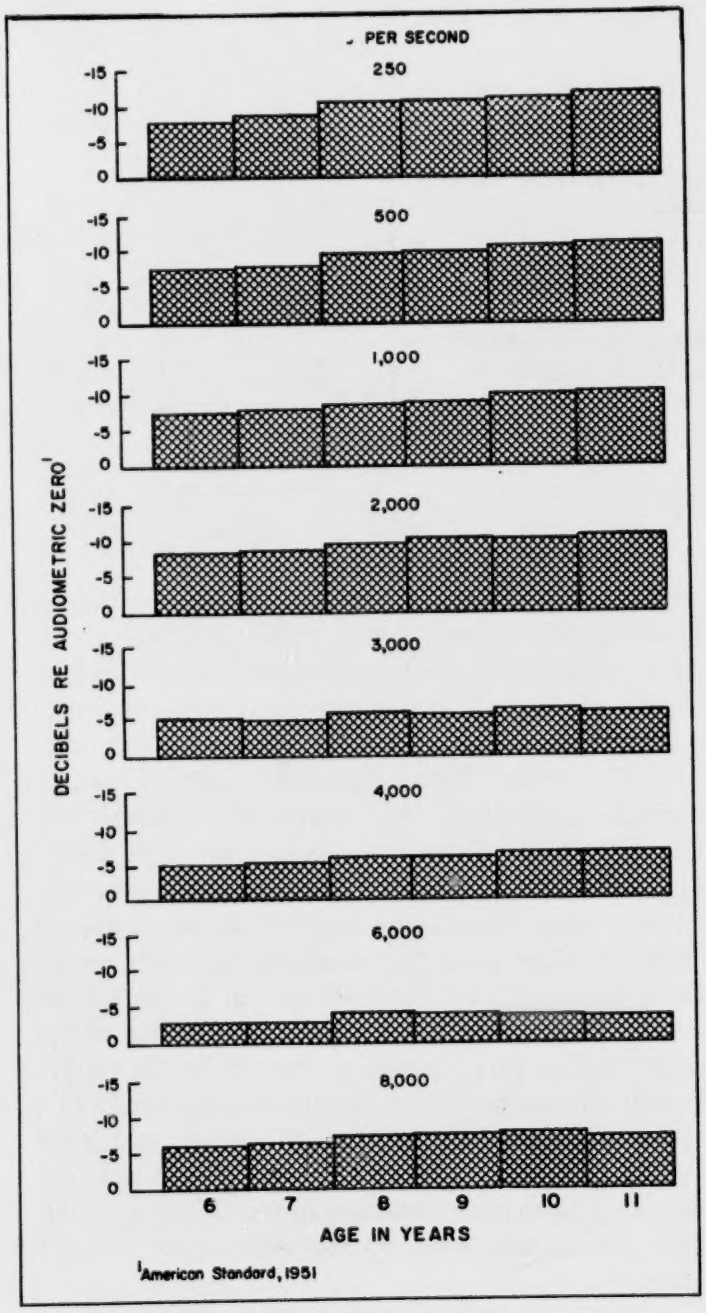

Figure 8. Median hearing levels for the better ear of children, by age at each test frequency, United States.

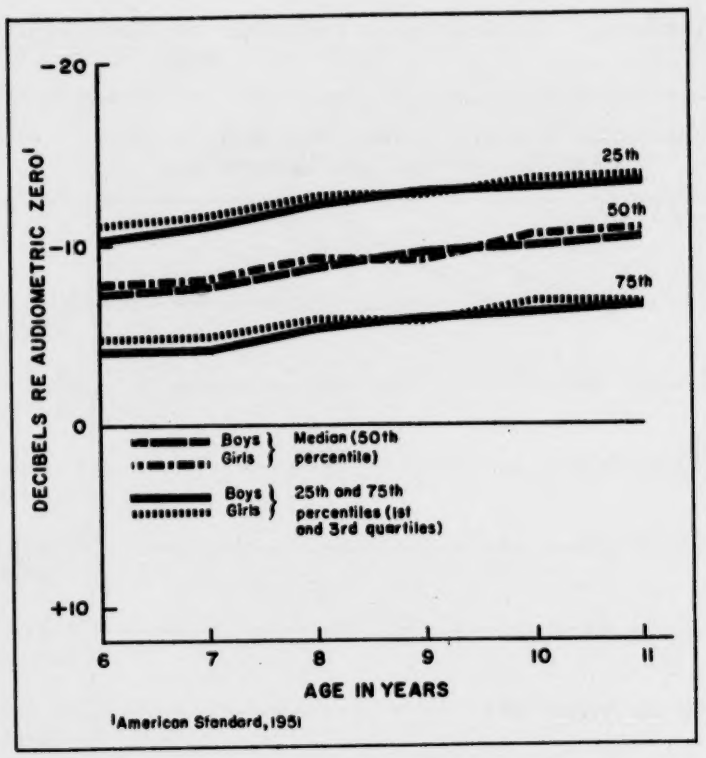

Figure 9. Medians and quartiles from the distribution of children 6-11 years, by hearing threshold levels for speech (average of pure-tone levels at 500, 1000, and 2000 cycles per second) in the better ear, United States.

Essentially all of these children fall within a group who have some difficulty with faint or normal speech. None were found to have such severe difficulty as to be unable to understand even amplified speech, indicating that the proportion among children of this age is too small to measure with the size sample used in this survey.

The findings of such a low prevalence of hearing handicaps among children reflects the limitation of the survey's target population to the noninstitutionalized. In particular, children living in special institutions for the hearing impaired would have been excluded.

At the other extreme, more than 9 percent of the children 6-11 years of age were found to have hearing levels of 15 decibels or more below audiometric zero (American Standard, 1951) within the range of frequencies usually considered most essential for understanding speech.

Table C. Estimated percentage of the child population, by gradation of hearing handicap: United States, 1963-65

Average hearing level for 500, 1000, and 2000 cps in the better ear	Ability to understand speech	Both sexes	Boys	Girls
		Percentage		
Less than 15 dB	No significant difficulty with faint speech	99.19	99.14	99.24
15-29 dB	Difficulty only with faint speech	0.71	0.72	0.69
30-44 dB	Frequent difficulty with normal speech	0.10	0.14	0.07
45-59 dB	Frequent difficulty with loud speech	*	*	*
60-79 dB	Understands only shouted or amplified speech	*	*	*
80 or more dB	Usual cannot understand even amplified speech	*	*	*

COMPARISON WITH FINDINGS FROM OTHER STUDIES

The present study is the first in which the findings are representative of the elementary school-age population of this country. In addition to the old National Health Survey of 1935-36, there have been several large-scale studies during recent years which obtained data on hearing thresholds of selected groups of young adults. Some of these were limited to the otologically normal and were done specifically to determine hearing level norms. In addition to these, a recent intensive study[13] was completed in Pittsburgh, Pennsylvania, during which hearing threshold levels were determined for children in the elementary schools. Reference is limited here to studies presenting findings on children or young adults in which the testing methods used were somewhat similar to those in the present survey.

The 1935-36 National Health Survey, from which data were used as the base for the 1951 American Standard audiometric zero, was the earliest of these large-scale studies.[7] This study presented data on 1,242 persons judged to be otologically normal, selected from a clinical investigation among some 9,000 persons of all ages residing in selected cities of the United States. Threshold levels were determined by air-conduction testing at eight pure tones—64, 128, 256, 512, 1024, 2048, 4096, and 8192 cycles per second—generated by standard audiometers (Western Electric 2-A, earphone type 552). Testing was done in booths constructed to give effective insulation from ambient noise. Because of the method used for selecting the study group from these urban communities, the findings cannot be assumed to be representative of the urban population of this country at the time of the study. It will be assumed here that threshold levels obtained at 256, 512, 1024, 2048, 4096, and 8192 cycles per second were approximately the same as would have been obtained at the 250, 500, 1000, 2000, 4000, and 8000 cycles used in the present study.

The 1960-62 Health Examination Survey presented data on a nationally representative sample of young adults 18-24 years of age.[14] This study as previously reported was based on a national probability sample of some 6,700 persons se-

lected to represent the civilian, noninstitutional population aged 18-79 years. Here the threshold levels were determined by air-conduction testing at six pure tones—500, 1000, 2000, 3000, 4,000, and 6000 cycles per second—generated by standard audiometers with TDH-39 earphones. Testing was done in booths constructed to achieve effective insulation.

From the 1955 Wisconsin State Fair, data have been presented on 122 persons 18-24 years of age considered to be otologically normal.[15] These subjects were selected from persons of all ages who were tested with standard audiometers by air-conduction (TDH-39 earphones) in prefabricated test rooms. Testing was done at nine tones—125, 250, 500, 1000, 2000, 3000, 4000, 6000, and 8000 cycles per second. The study group was drawn from among those attending the fair—primarily from Milwaukee and surrounding areas.

A British study conducted by Dadson and King in 1952 presented data on 99 persons 18-24 years of age considered to be otologically normal.[16] Testing was done with standard audiometers by air-conduction (4026-A earphones) in a highly silent, absorbent room. Testing was carried out with pure tones at 14 frequencies—80, 125, 250, 500, 1000, 1500, 2000, 3000, 4000, 6000, 8000, 10000, 12000, and 15000 cycles per second. All the subjects were employees of the National Physical Laboratory and were trained, highly motivated listeners.

The University of Pittsburgh Graduate School of Public Health, in cooperation with the Committee on Conservation of Hearing of the American Academy of Ophthalmology and Otolaryngology, conducted a study from 1958 to 1960 on a group of 4,078 children in the public and private schools of Pittsburgh, Pennsylvania, who were between 5 and 14 years of age. In this study, threshold levels were determined by air-conduction testing at seven pure tones—250, 500, 1000, 2000, 4000, 6000, and 8000 cycles per second generated by standard audiometers (WE-705A earphones). Testing was done in prefabricated test rooms constructed to achieve effective attenuation of ambient noise. The study group was selected to be a representative cross section of the Pittsburgh elementary school population.[13]

Findings from the various studies cited in this section have been converted to the uniform basis of the TDH-39 earphones on the NBS 9-A coupler expressed in decibels re 0.0002 dynes per square centimeter. This is a scale different from that used in data presented elsewhere in this report (appendix III). Factors which cannot be compensated for are differences in acoustical environment, testing technique, stability of the instruments used, and selection and motivation of the test subjects. These are confounded with any real differences that may exist among the populations themselves.

The median hearing levels obtained from the present study differ quite substantially from those found in the 1935-36 National Health Survey which were used in determining the 1951 American Standard reference zero (fig. 10).[8,17] The levels for children (ages 6-11 years) in the present study are from 4 to 9 decibels lower (better), depending on the frequency, than those of the otoscopically normal young adults in the 1935-36 National Health Survey.

Findings from the present study are in much closer agreement with the results of more recent studies which present data on hearing levels of young adults. The median hearing levels found in

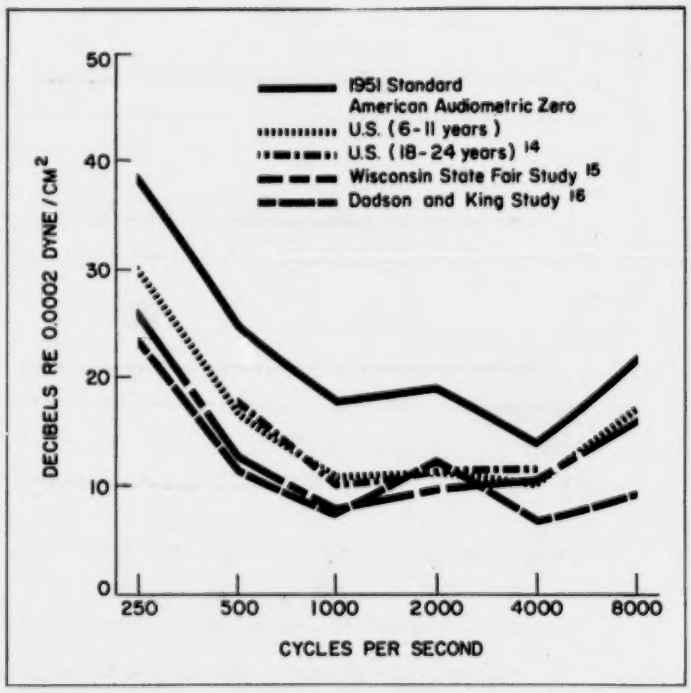

Figure 10. Median hearing threshold levels (in decibels re 0.0002 dyne per cm^2) for children and young adults at six frequencies, from selected studies.

the present study differ by no more than 1.5 decibels from the median hearing levels for young adults (18-24 years of age) in the 1960-62 Health Examination Survey—a difference that could easily have arisen through sampling errors alone.

Children in the present survey were found to have similar, but slightly more sensitive, hearing levels than those reported from the Pittsburgh study (6-11 years of age) as shown in figure 11. The differences between the overall median hearing level ranges from 0.5 decibels to 4 decibels depending on frequency. For all frequencies except 250 cycles, findings for the children from the Health Examination Survey showed somewhat lower (better) median hearing levels. As in the present survey, the Pittsburgh study also found that although there was very little difference between boys and girls of that city, girls had more sensitive hearing levels than boys at all frequencies except 250 cps.

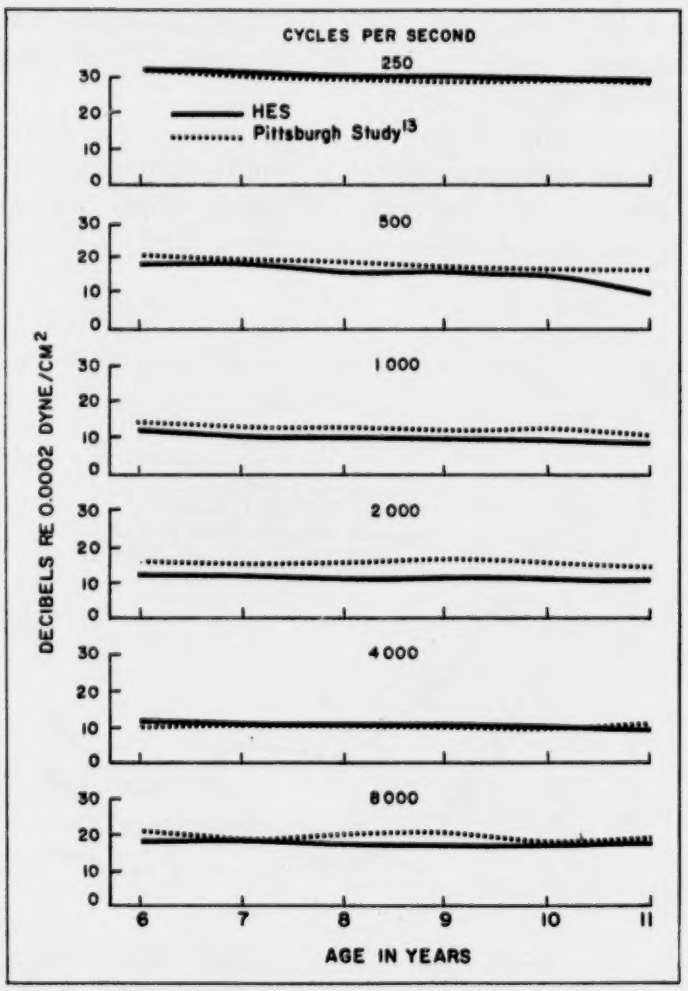

Figure 11. Median hearing threshold levels (in decibels re 0.0002 dyne per cm^2) for the right ear of children at each test frequency, by age from the present study and the Pittsburgh study.

The general pattern of an increase in hearing sensitivity with advancing age among young school-age children is found consistently from both the present study for the entire United States and the Pittsburgh study, as shown in figure 11. In both studies, this trend seems to be more marked at the lower frequencies—250, 500, and 1000 cycles.

To what extent the difference among these several studies may be due to variations in testing conditions, to population differences, or to secular changes in hearing levels, if any, can only be a matter of conjecture.

SUMMARY

Monaural hearing threshold level findings for children 6-11 years of age in the noninstitutional population of the United States as determined in the Health Examination Survey of 1963-65 have been described and analyzed in this report.

These findings show:

1. For the better ear more than 70 percent had hearing thresholds below (better than) audiometric zero (1951 American Standard) at all frequencies tested.
2. Hearing was somewhat poorer at 3000, 4000, 6000, and 8000 cycles per second than at the lower test frequencies.
3. Hearing thresholds for the right ear as compared with the left ear were similar for most of the children. The extent of agreement is slightly poorer for the higher frequencies, 4000 cycles and above, than for the lower.
4. There was little difference between the hearing threshold levels of boys and girls.
5. At the lower tones, 250-2000 cycles per second, there tends to be a pattern of increasing hearing sensitivity with advancing age of children.

6. The prevalence of hearing handicaps as estimated from pure-tone audiometric testing in the survey is quite low. The proportion with some degree of hearing handicap—thresholds at 500, 1000, and 2000 cycles (average) of 15 decibels or more—is slightly less than 1 percent among children 6-11 years of age. The estimated number of children of this age with hearing handicaps is 213,000; however, this does not include children who reside in special schools for the hearing impaired or in other institutions.

The type of hearing examination given, the methods used in the measurement of hearing levels, the acoustical environment, the audiometric calibration and other types of quality control measures have been described. Comparisons have been included with previous large-scale studies among children and young adults in which similar testing methods were used.

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Ear and tonal frequency	Hearing levels in decibels										
	All levels	-25 or less	-24 to -15	-14 to -5	-4 to +5	+6 to +15	+16 to +25	+26 to +35	+36 to +45	+46 to +55	+56 or more
	Percentage distribution										
Right ear											
250 cps	100.0	0.2	10.8	60.6	24.0	3.2	0.9	0.2	0.1	-	-
500 cps	100.0	0.2	9.5	58.5	26.4	3.9	1.2	0.3	-	-	-
1000 cps	100.0	-	5.8	56.1	30.9	5.2	1.3	0.5	0.2	-	-
2000 cps	100.0	0.1	9.2	59.0	26.6	3.6	1.0	0.4	0.1	-	-
3000 cps	100.0	0.1	3.5	38.1	47.9	8.3	1.2	0.4	0.3	0.1	0.1
4000 cps	100.0	-	2.2	38.3	45.8	10.4	1.9	0.9	0.3	0.1	0.1
6000 cps	100.0	-	2.4	27.4	44.5	19.1	3.9	1.4	0.7	0.1	0.5
8000 cps	100.0	0.2	6.1	40.3	36.6	11.5	3.3	1.3	0.3	0.1	0.3
Left ear											
250 cps	100.0	0.1	10.5	58.8	25.1	4.1	1.0	0.2	0.1	-	0.1
500 cps	100.0	0.5	9.5	57.0	27.5	3.9	1.2	0.3	0.1	-	-
1000 cps	100.0	-	6.8	55.0	31.1	5.0	1.3	0.6	0.2	-	-
2000 cps	100.0	0.1	8.7	57.4	28.7	3.9	0.7	0.3	0.1	0.1	-
3000 cps	100.0	-	2.8	37.4	48.2	9.2	1.4	0.6	0.2	0.1	0.1
4000 cps	100.0	0.1	2.7	34.7	48.5	10.4	1.8	1.0	0.4	0.3	0.1
6000 cps	100.0	0.1	2.4	23.1	44.5	21.4	4.8	2.0	1.0	0.2	0.5
8000 cps	100.0	0.1	6.7	38.8	38.6	10.7	2.9	1.1	0.7	0.1	0.3
Better Ear											
250 cps	100.0	0.3	15.4	66.1	16.1	1.8	0.3	-	-	-	-
500 cps	100.0	0.5	13.8	63.5	19.9	1.8	0.5	-	-	-	-
1000 cps	100.0	-	9.8	63.2	23.5	2.7	0.5	0.2	0.1	-	-
2000 cps	100.0	0.3	14.1	65.3	18.3	1.5	0.3	0.1	0.1	-	-
3000 cps	100.0	0.1	5.2	47.6	41.6	4.6	0.6	0.2	0.1	-	-
4000 cps	100.0	0.1	4.2	48.1	41.0	5.4	0.7	0.3	0.1	0.1	-
6000 cps	100.0	0.1	4.2	36.7	44.4	12.1	1.7	0.5	0.1	0.1	0.1
8000 cps	100.0	0.3	10.5	50.5	30.7	5.9	1.5	0.3	0.2	-	0.1

[1]American Standard, 1951.

Table 2. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the right ear at 250 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Percentage distribution						
Both sexes							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.2	0.1	0.1	0.7	0.1	0.3	0.1
-24 to -15	10.8	4.8	6.7	10.8	12.2	14.8	16.3
-14 to -05	60.5	52.3	58.4	62.3	61.3	63.9	65.1
-04 to +05	24.0	35.4	31.1	21.8	22.2	17.3	15.2
+06 to +15	3.3	5.3	2.8	3.5	3.0	2.6	2.2
+16 to +25	0.9	1.8	0.8	0.5	0.8	0.8	0.8
+26 to +35	0.2	0.2	0.1	0.1	0.1	0.1	0.2
+36 or greater	0.1	0.1	-	0.3	0.3	0.2	0.1
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	0.3	-	0.2	-	0.6	0.1
-24 to -15	11.9	4.9	7.1	11.7	14.5	16.5	17.5
-14 to -05	61.7	53.7	60.2	63.2	62.8	62.8	67.6
-04 to +05	22.4	35.1	29.2	19.8	19.7	16.5	12.7
+06 to +15	2.7	3.7	2.3	4.2	2.1	3.2	0.9
+16 to +25	1.0	2.1	1.0	0.5	0.8	0.4	1.0
+26 to +35	0.1	-	0.2	0.2	-	-	0.1
+36 or greater	0.1	0.2	-	0.2	0.1	-	0.1
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.3	-	0.1	1.3	0.2	-	0.1
-24 to -15	9.7	4.7	6.3	10.0	9.8	13.0	15.1
-14 to -05	59.2	50.7	56.7	61.2	59.8	64.9	62.6
-04 to +05	25.7	35.7	33.0	23.9	24.8	18.1	17.7
+06 to +15	3.8	6.9	3.2	2.8	3.9	2.1	3.5
+16 to +25	0.9	1.5	0.7	0.4	0.8	1.2	0.6
+26 to +35	0.2	0.5	-	-	0.3	0.3	0.4
+36 or greater	0.2	-	-	0.4	0.4	0.4	-

[1]American Standard, 1951.

Table 3. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the left ear at 250 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Percentage distribution						
Both sexes							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	0.1	-	0.2	0.1	0.3	-
-24 to -15	10.4	5.0	6.7	11.2	10.8	14.4	15.2
-14 to -05	58.9	53.0	57.4	59.9	60.7	61.0	61.7
-04 to +05	25.1	35.0	29.8	23.1	22.6	20.0	19.1
+06 to +15	4.1	5.4	4.7	4.4	4.0	3.3	2.7
+16 to +25	1.0	1.0	1.1	1.0	1.5	0.4	1.1
+26 to +35	0.2	0.0	0.1	0.1	0.3	0.4	0.1
+36 or greater	0.2	0.5	0.2	0.1	-	0.2	0.1
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	0.1	-	-	0.2	0.4	-
-24 to -15	11.6	5.7	8.3	12.6	12.3	15.0	16.5
-14 to -05	59.6	51.2	57.9	59.8	62.2	62.8	64.0
-04 to +05	24.0	37.2	29.5	21.3	20.8	18.5	15.5
+06 to +15	3.5	4.0	3.4	5.0	3.1	2.7	2.8
+16 to +25	0.9	0.9	0.9	1.1	1.3	0.4	0.9
+26 to +35	0.1	0.1	-	0.1	0.1	-	0.3
+36 or greater	0.2	0.8	-	0.1	-	0.2	-
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	-	0.3	0.1	0.3	-
-24 to -15	9.3	4.2	5.2	-	9.3	13.7	13.9
-14 to -05	58.3	55.1	56.9	9.8	59.1	59.2	59.2
-04 to +05	26.2	32.7	30.1	60.2	24.4	21.6	22.9
+06 to +15	4.7	6.8	6.1	25.0	4.9	3.9	2.5
+16 to +25	1.1	1.1	1.3	3.8	1.7	0.5	1.3
+26 to +35	0.2	-	0.1	0.8	0.5	0.8	-
+36 or greater	0.1	0.1	0.3	0.1	-	0.2	0.2

[1]American Standard, 1951.

Table 4. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the right ear at 500 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Percentage distribution						
Both sexes							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.2	0.1	0.4	0.7	-	0.2	0.1
-24 to -15	9.5	4.6	5.3	9.9	10.5	14.1	13.2
-14 to -05	58.4	49.1	56.1	58.5	59.3	63.1	65.2
-04 to +05	26.4	38.5	32.1	25.8	24.9	18.3	17.4
+06 to +15	3.9	5.7	4.8	3.6	3.7	2.8	2.8
+16 to +25	1.2	1.7	1.3	1.2	1.1	1.0	0.9
+26 to +35	0.3	0.3	0.0	0.2	0.4	0.4	0.2
+36 or greater	0.1	-	-	0.1	0.1	0.1	0.2
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.2	0.1	0.6	0.1	-	0.2	-
-24 to -15	9.4	5.8	4.1	9.6	10.7	12.7	14.1
-14 to -05	58.8	48.7	55.4	57.2	62.4	63.1	67.3
-04 to +05	26.1	36.8	33.8	27.4	22.1	19.6	15.7
+06 to +15	4.0	6.6	4.5	3.6	4.0	3.2	2.0
+16 to +25	1.2	1.8	1.4	1.7	0.4	1.0	0.7
+26 to +35	0.2	0.2	0.2	0.4	0.2	0.2	0.1
+36 or greater	0.1	-	-	-	0.2	-	0.1
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.3	0.1	0.1	1.2	-	0.2	0.2
-24 to -15	9.6	3.4	6.6	10.1	10.3	15.5	12.4
-14 to -05	58.1	49.5	56.8	59.9	56.1	63.2	63.0
-04 to +05	26.6	40.2	30.3	24.1	27.8	16.9	19.2
+06 to +15	3.8	4.9	5.0	3.7	3.3	2.3	3.7
+16 to +25	1.3	1.6	1.2	0.8	1.8	1.1	1.1
+26 to +35	0.3	0.3	-	-	0.7	0.6	0.2
+36 or greater	-	-	-	0.2	-	0.2	0.2

[1]American Standard, 1951.

Table 5. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the left ear at 500 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Percentage distribution						
Both sexes							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.5	0.2	0.4	0.9	0.4	0.4	0.4
-24 to -15	9.5	4.9	5.6	10.3	9.9	13.0	13.9
-14 to -05	57.0	51.4	53.7	56.3	57.9	61.1	62.1
-04 to +05	27.5	37.9	34.3	25.5	25.5	21.6	19.4
+06 to +15	3.9	4.1	4.4	5.0	4.5	2.5	2.8
+16 to +25	1.2	1.2	1.4	1.4	1.2	0.9	0.9
+26 to +35	0.3	0.1	0.2	0.5	0.5	0.2	0.4
+36 or greater	0.1	0.2	-	0.1	0.1	0.3	0.1
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.3	0.4	0.6	0.1	0.4	0.2	-
-24 to -15	9.3	4.7	5.2	9.8	11.5	10.6	14.8
-14 to -05	56.8	49.0	53.5	55.4	57.5	62.8	62.7
-04 to +05	27.9	38.6	33.6	26.5	25.4	23.1	19.1
+06 to +15	4.2	5.0	5.6	5.7	4.0	2.2	2.3
+16 to +25	1.1	1.7	1.5	1.5	0.9	0.5	0.7
+26 to +35	0.3	0.2	-	0.9	0.3	0.4	0.3
+36 or greater	0.1	0.4	-	0.1	-	0.2	0.1
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.6	0.1	0.3	1.6	0.5	0.6	0.7
-24 to -15	9.6	5.0	6.0	10.8	8.2	15.4	13.0
-14 to -05	57.4	53.7	53.9	57.4	58.3	59.3	61.4
-04 to +05	27.2	37.1	35.1	24.5	25.5	20.1	19.7
+06 to +15	3.6	3.2	3.1	4.2	5.1	2.8	3.4
+16 to +25	1.2	0.8	1.3	1.2	1.5	1.4	1.2
+26 to +35	0.3	-	0.3	0.3	0.7	-	0.4
+36 or greater	0.1	0.1	-	-	0.2	0.4	0.2

[1]American Standard, 1951.

Table 6. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the right ear at 1000 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Percentage distribution						
Both sexes							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	0.0	-	0.1	0.1	-
-24 to -15	5.8	3.9	3.9	5.0	6.2	8.4	7.2
-14 to -05	56.0	49.1	53.7	55.2	54.9	60.5	63.7
-04 to +05	30.9	37.4	33.5	32.2	32.6	25.0	23.8
+06 to +15	5.2	7.2	6.5	5.6	4.3	3.8	3.7
+16 to +25	1.3	1.6	1.6	1.1	0.9	1.3	1.2
+26 to +35	0.5	0.7	0.8	0.4	0.7	0.5	0.2
+36 or greater	0.2	0.1	-	0.5	0.3	0.4	0.2
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	-	-	-	-	-	0.2	-
-24 to -15	5.4	2.8	4.0	5.3	7.5	7.2	6.1
-14 to -05	56.8	50.9	52.7	53.3	57.5	60.2	65.9
-04 to +05	30.6	36.6	34.0	33.3	29.6	25.6	23.4
+06 to +15	5.2	6.3	7.2	5.7	4.1	4.1	3.5
+16 to +25	1.2	2.2	1.1	1.3	0.3	1.9	0.6
+26 to +35	0.6	1.2	1.0	0.5	0.7	0.2	0.2
+36 or greater	0.2	-	-	0.6	0.3	0.6	0.3
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	0.1	-	0.2	-	-
-24 to -15	6.1	5.1	3.8	4.8	5.0	9.7	8.4
-14 to -05	55.5	47.4	54.6	57.1	52.1	60.8	61.5
-04 to +05	31.2	38.2	33.1	31.1	35.7	24.4	24.3
+06 to +15	5.2	8.0	5.7	5.3	4.5	3.4	4.0
+16 to +25	1.3	1.0	2.1	0.9	1.6	0.7	1.7
+26 to +35	0.5	0.1	0.6	0.4	0.7	0.8	0.1
+36 or greater	0.1	0.2	-	0.4	0.2	0.2	-

[1]American Standard, 1951.

Table 7. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the left ear at 1000 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
Both sexes	Percentage distribution						
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	0.1	0.1	0.1	-	0.1	-
-24 to -15	6.8	3.8	5.1	6.8	7.9	8.3	8.8
-14 to -05	54.8	48.9	49.5	55.6	55.3	58.8	61.8
-04 to +05	31.2	38.2	37.7	30.4	29.7	27.2	23.4
+06 to +15	5.0	7.0	5.3	4.4	5.1	3.7	4.3
+16 to +25	1.3	1.5	1.4	1.7	1.2	0.9	1.0
+26 to +35	0.6	0.3	0.8	0.6	0.6	0.7	0.4
+36 or greater	0.2	0.2	0.1	0.4	0.2	0.3	0.3
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	-	-	-	-	-	0.2	-
-24 to -15	6.2	4.0	5.3	6.3	7.9	6.4	7.3
-14 to -05	54.2	47.1	47.5	52.3	57.4	58.1	63.5
-04 to +05	32.3	38.7	39.1	33.1	27.5	29.9	24.7
+06 to +15	5.3	7.2	5.8	5.3	5.6	4.0	3.4
+16 to +25	1.1	2.2	0.9	1.5	1.2	0.2	0.4
+26 to +35	0.7	0.4	1.4	0.8	0.3	1.0	0.4
+36 or greater	0.2	0.4	-	0.7	0.1	0.2	0.3
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	0.2	0.1	0.1	-	-	-
-24 to -15	7.4	3.8	4.9	7.4	8.0	10.3	10.3
-14 to -05	55.6	50.6	51.7	59.2	53.0	59.4	60.2
-04 to +05	30.1	37.7	36.2	27.6	31.9	24.5	21.9
+06 to +15	4.8	6.7	4.7	3.5	4.7	3.5	5.5
+16 to +25	1.4	0.7	1.8	1.8	1.2	1.6	1.5
+26 to +35	0.4	0.3	0.4	0.4	0.8	0.3	0.4
+36 or greater	0.2	-	0.2	-	0.4	0.4	0.2

[1] American Standard, 1951.

Table 8. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the right ear at 2000 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Percentage distribution						
Both sexes							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.2	0.2	0.1	0.3	0.1	0.4	-
-24 to -15	9.2	7.2	7.4	9.8	9.2	10.7	11.1
-14 to -05	58.9	52.2	58.9	60.4	61.1	59.7	61.2
-04 to +05	26.6	34.7	29.2	23.7	24.4	24.0	22.9
+06 to +15	3.6	4.2	3.2	4.6	3.1	3.6	3.0
+16 to +25	1.0	1.3	1.1	0.7	1.4	1.0	0.3
+26 to +35	0.4	0.2	0.1	0.4	0.4	0.2	1.2
+36 or greater	0.1	-	-	0.1	0.3	0.4	0.3
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	-	-	-	0.3	-
-24 to -15	8.8	7.1	6.7	8.7	9.3	10.0	11.5
-14 to -05	58.6	48.0	60.8	62.3	62.2	58.8	59.5
-04 to +05	27.1	39.5	27.8	22.1	23.0	24.8	24.9
+06 to +15	4.2	4.1	4.3	5.5	3.9	4.6	2.8
+16 to +25	0.6	1.1	0.2	0.8	1.0	0.6	0.1
+26 to +35	0.4	0.2	0.2	0.6	0.3	0.4	0.7
+36 or greater	0.2	-	-	-	0.3	0.5	0.5
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.3	0.3	0.3	0.6	0.2	0.4	-
-24 to -15	9.6	7.3	8.0	11.0	9.2	11.3	10.6
-14 to -05	59.2	56.5	57.1	58.3	59.7	60.6	62.9
-04 to +05	26.0	29.8	30.6	25.3	25.9	23.1	20.9
+06 to +15	3.0	4.4	2.0	3.6	2.4	2.6	3.3
+16 to +25	1.3	1.5	2.0	0.7	1.7	1.4	0.5
+26 to +35	0.5	0.2	-	0.2	0.5	0.4	1.7
+36 or greater	0.1	-	-	0.3	0.4	0.2	0.1

[1]American Standard, 1951.

Table 9. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the left ear at 2000 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Percentage distribution						
Both sexes							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	0.2	0.2	0.1	0.2	0.1
-24 to -15	8.7	6.0	5.8	9.6	11.1	10.3	9.6
-14 to -05	57.4	54.3	54.6	58.6	56.5	59.2	61.6
-04 to +05	28.7	34.8	33.2	26.6	27.3	26.1	23.2
+06 to +15	3.9	4.2	5.4	3.5	3.7	3.0	3.4
+16 to +25	0.7	0.4	0.6	0.7	0.7	0.9	1.1
+26 to +35	0.3	0.1	-	0.6	0.3	-	0.7
+36 or greater	0.2	0.2	0.2	0.2	0.3	0.3	0.3
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	-	0.2	0.1	0.3	0.1
-24 to -15	8.1	4.6	5.7	10.1	9.6	9.5	9.2
-14 to -05	56.6	54.3	53.6	55.8	58.3	58.1	59.2
-04 to +05	29.8	34.8	33.9	28.4	27.0	28.6	25.6
+06 to +15	4.3	5.3	6.1	3.8	4.2	2.6	3.9
+16 to +25	0.6	0.6	0.7	0.3	0.5	0.6	0.9
+26 to +35	0.3	-	-	1.2	0.3	-	0.6
+36 or greater	0.2	0.4	-	0.2	-	0.3	0.5
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.2	-	0.4	0.2	0.2	0.1	0.1
-24 to -15	9.3	7.4	5.9	9.1	12.6	11.1	10.0
-14 to -05	58.3	54.1	55.8	61.5	54.7	60.2	64.3
-04 to +05	27.5	35.0	32.5	24.8	27.6	23.6	20.8
+06 to +15	3.4	3.0	4.6	3.2	3.1	3.4	2.8
+16 to +25	0.8	0.2	0.5	1.1	0.9	1.2	1.2
+26 to +35	0.2	0.2	-	0.1	0.3	-	0.7
+36 or greater	0.3	0.1	0.3	-	0.6	0.4	0.1

[1]American Standard, 1951.

Table 10. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the right ear at 3000 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
Both sexes	Percentage distribution						
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	0.1	0.1	-	0.2	0.2	-
-24 to -15	3.5	3.1	3.1	4.1	3.1	4.3	3.3
-14 to -05	38.1	36.5	33.2	38.4	37.9	41.7	41.3
-04 to +05	47.9	49.3	53.2	45.6	48.1	43.9	46.7
+06 to +15	8.3	8.8	8.5	10.1	8.7	7.4	5.9
+16 to +25	1.2	1.4	1.2	1.2	0.9	1.3	1.3
+26 to +35	0.4	0.3	0.4	0.1	0.6	0.4	0.5
+36 and greater	0.5	0.5	0.3	0.5	0.5	0.8	1.0
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	0.2	-	-	-	0.2	-
-24 to -15	3.3	2.2	3.3	3.7	3.7	4.1	2.7
-14 to -05	37.7	34.4	32.9	37.6	40.0	41.0	40.6
-04 to +05	47.4	51.1	51.1	45.5	44.6	44.2	48.1
+06 to +15	9.2	9.1	10.2	11.7	10.5	7.8	6.0
+16 to +25	1.1	1.7	1.4	0.8	0.3	1.2	1.1
+26 to +35	0.5	0.6	0.6	0.2	0.5	0.5	0.5
+36 and greater	0.7	0.7	0.5	0.5	0.4	1.0	1.0
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	0.1	-	0.4	0.2	-
-24 to -15	3.7	4.0	2.9	4.4	2.6	4.4	4.0
-14 to -05	38.6	38.7	33.5	39.2	35.8	42.5	42.0
-04 to +05	48.3	47.3	55.5	45.6	51.7	43.5	45.1
+06 to +15	7.2	8.6	6.7	8.4	6.8	7.0	5.9
+16 to +25	1.4	1.2	1.1	1.8	1.5	1.4	1.5
+26 to +35	0.3	-	0.2	0.2	0.8	0.4	0.6
+36 and greater	0.4	0.2	-	0.4	0.4	0.6	0.9

[1]American Standard, 1951.

Table 11. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the left ear at 3000 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Percentage distribution						
Both sexes							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	0.1	-	0.1	0.2	0.1
-24 to -15	2.8	2.0	1.8	3.9	2.8	3.5	3.0
-14 to -05	37.4	34.3	34.2	37.7	38.0	40.4	39.8
-04 to +05	48.2	50.9	52.3	45.7	47.0	46.5	46.7
+06 to +15	9.2	10.3	9.2	10.2	10.2	7.1	7.8
+16 to +25	1.3	1.9	1.3	1.6	0.7	1.3	1.3
+26 to +35	0.6	-	1.0	0.7	0.8	0.5	0.6
+36 or greater	0.4	0.6	0.1	0.2	0.4	0.5	0.7
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	-	-	-	0.2	0.1
-24 to -15	2.6	1.7	1.6	3.4	2.3	3.6	3.0
-14 to -05	35.8	33.1	32.3	34.6	39.4	39.3	36.5
-04 to +05	48.7	48.6	53.1	48.8	47.2	45.9	48.6
+06 to +15	10.3	13.1	10.5	10.9	9.8	8.3	9.0
+16 to +25	1.4	2.9	0.9	1.2	0.5	1.6	1.2
+26 to +35	0.7	-	1.6	0.8	0.5	0.5	0.9
+36 or greater	0.4	0.6	-	0.3	0.3	0.6	0.7
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	0.1	-	0.3	0.1	-
-24 to -15	3.1	2.4	2.0	4.5	3.2	3.3	3.0
-14 to -05	39.0	35.6	36.2	40.9	36.6	41.6	43.2
-04 to +05	47.6	53.1	51.6	42.4	46.9	47.2	44.7
+06 to +15	8.0	7.5	7.8	9.4	10.6	6.0	6.5
+16 to +25	1.3	0.8	1.8	2.2	0.8	0.9	1.4
+26 to +35	0.5	-	0.3	0.5	1.0	0.5	0.4
+36 or greater	0.4	0.6	0.2	0.1	0.6	0.4	0.8

[1]American Standard, 1951.

Table 12. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the right ear at 4000 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Percentage distribution						
Both sexes							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.0	-	-	0.1	-	-	-
-24 to -15	2.3	1.4	1.9	2.3	2.8	2.6	2.4
-14 to -05	38.3	32.6	36.4	38.3	40.1	40.6	42.2
-04 to +05	45.7	48.6	47.2	46.2	44.7	45.3	41.6
+06 to +15	10.4	14.2	11.0	10.0	9.1	8.6	9.5
+16 to +25	1.9	1.6	2.6	2.4	1.6	1.2	2.1
+26 to +35	0.9	1.5	0.6	0.5	1.0	0.8	0.6
+36 or greater	0.5	0.1	0.3	0.2	0.7	0.9	1.6
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	-	-	-	-	-	0.2	-
-24 to -15	1.9	1.4	0.6	2.2	2.6	2.5	2.0
-14 to -05	38.2	31.1	34.7	37.6	42.7	39.8	44.2
-04 to +05	45.6	49.1	50.5	47.6	41.5	44.0	39.9
+06 to +15	10.8	14.5	10.6	9.0	10.7	10.5	9.5
+16 to +25	1.9	1.8	2.5	2.8	0.9	1.4	2.0
+26 to +35	1.0	2.1	0.6	0.8	1.2	0.7	0.4
+36 or greater	0.6	-	0.5	-	0.4	0.9	2.0
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	-	-	-	0.2	-	-	-
-24 to -15	2.6	1.5	3.2	2.5	3.1	2.8	2.8
-14 to -05	38.3	34.2	38.2	39.1	37.3	41.5	40.2
-04 to +05	45.9	48.0	43.9	44.7	47.9	46.7	43.5
+06 to +15	10.0	13.9	11.4	10.9	7.4	6.7	9.5
+16 to +25	1.9	1.4	2.7	1.9	2.3	0.8	2.2
+26 to +35	0.7	0.9	0.6	0.3	0.9	0.8	0.8
+36 or greater	0.6	0.1	-	0.4	1.1	0.7	1.0

[1] American Standard, 1951.

Table 13. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the left ear at 4000 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Percentage distribution						
Both sexes							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	-	0.1	0.1	0.1	0.3
-24 to -15	2.7	2.4	2.1	4.0	2.6	3.1	1.8
-14 to -05	34.7	31.0	31.6	33.9	35.6	39.4	37.1
-04 to +05	48.6	51.5	51.5	48.4	48.1	45.7	45.9
+06 to +15	10.4	11.9	10.7	10.1	10.5	8.7	10.4
+16 to +25	1.8	1.7	2.6	1.7	1.5	1.7	1.7
+26 to +35	1.0	1.2	0.9	0.9	1.1	0.4	1.3
+36 or greater	0.7	0.3	0.6	0.9	0.5	0.9	1.5
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	-	-	-	-	-	0.2	-
-24 to -15	2.6	2.0	1.2	4.3	3.0	3.6	1.4
-14 to -05	34.7	29.7	33.2	33.7	37.0	36.6	38.3
-04 to +05	47.5	51.6	48.9	46.5	47.3	45.7	45.8
+06 to +15	11.1	12.2	12.9	11.4	9.6	10.8	9.2
+16 to +25	2.0	2.3	1.9	2.1	1.6	1.6	2.3
+26 to +35	1.1	1.8	1.1	1.1	0.9	0.6	0.8
+36 or greater	1.0	0.4	0.8	0.9	0.6	0.9	2.2
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	-	0.2	0.2	-	0.6
-24 to -15	2.7	2.9	3.0	3.7	2.2	2.6	2.1
-14 to -05	34.7	32.4	30.0	34.1	34.2	42.3	35.9
-04 to +05	49.6	51.4	54.0	50.2	49.0	45.8	46.1
+06 to +15	9.8	11.6	8.4	8.9	11.3	6.5	11.7
+16 to +25	1.7	1.1	3.4	1.3	1.4	1.7	1.2
+26 to +35	0.9	0.5	0.8	0.6	1.3	0.2	1.9
+36 or greater	0.5	0.1	0.4	1.0	0.4	0.9	0.5

[1]American Standard, 1951.

Table 14. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the right ear at 6000 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Percentage distribution						
Both sexes							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.0	-	-	-	-	0.1	-
-24 to -15	2.4	0.6	1.6	3.0	2.8	3.1	3.2
-14 to -05	27.4	25.1	24.0	30.0	29.9	28.1	27.7
-04 to +05	44.5	46.3	47.8	42.9	42.5	45.2	42.1
+06 to +15	19.1	20.7	20.7	18.4	17.3	16.6	20.4
+16 to +25	3.9	4.5	3.3	3.6	4.5	3.8	3.8
+26 to +35	1.4	1.1	1.8	1.1	1.6	1.5	1.3
+36 to +45	0.7	1.1	0.5	0.7	0.8	1.0	0.3
+46 or greater	0.6	0.6	0.3	0.3	0.6	0.6	1.2
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	-	-	-	-	-	0.2	-
-24 to -15	2.2	0.8	1.3	2.4	3.2	3.0	2.8
-14 to -05	28.0	26.1	25.0	30.0	32.5	26.2	28.1
-04 to +05	43.2	44.0	45.6	42.0	39.8	46.0	41.5
+06 to +15	19.2	20.7	20.9	19.3	17.5	15.8	20.7
+16 to +25	4.3	5.6	4.2	3.7	3.8	5.1	3.2
+26 to +35	1.5	1.0	2.0	1.7	1.4	1.4	1.8
+36 to +45	0.8	1.4	0.6	0.5	1.1	1.2	0.2
+46 or greater	0.8	0.4	0.4	0.4	0.7	1.1	1.7
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	-	-	-	-	-	0.1	-
-24 to -15	2.5	0.3	1.9	3.7	2.3	3.2	3.6
-14 to -05	26.9	24.2	23.0	30.1	27.1	29.9	27.2
-04 to +05	46.0	48.5	50.2	43.8	45.4	44.2	42.9
+06 to +15	18.9	20.7	20.6	17.5	17.2	17.5	20.1
+16 to +25	3.5	3.5	2.2	3.4	5.2	2.5	4.4
+26 to +35	1.2	1.2	1.6	0.5	1.8	1.6	0.8
+36 to +45	0.6	0.8	0.4	0.9	0.6	0.8	0.3
+46 or greater	0.4	0.8	0.1	0.1	0.4	0.2	0.7

[1]American Standard, 1951.

Table 15. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the left ear at 6000 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Percentage distribution						
Both sexes							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	-	0.2	0.1	0.1	0.1
-24 to -15	2.4	1.2	2.6	3.0	2.4	3.2	2.1
-14 to -05	23.2	22.6	22.1	24.6	23.6	23.4	22.6
-04 to +05	44.5	47.1	43.8	45.5	44.4	44.5	41.5
+06 to +15	21.4	21.5	22.9	19.0	21.0	21.5	22.8
+16 to +25	4.8	4.5	5.0	4.7	4.5	3.9	6.3
+26 to +35	2.0	2.0	2.3	2.1	1.8	1.7	2.0
+36 to +45	0.9	0.6	1.2	0.3	1.0	1.0	1.8
+46 or greater	0.7	0.5	0.1	0.6	1.2	0.7	0.8
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	-	-	-	0.2	0.1
-24 to -15	2.4	0.9	2.0	2.5	2.3	4.1	2.6
-14 to -05	22.3	20.4	21.1	23.4	25.3	21.4	22.3
-04 to +05	44.7	48.5	46.8	45.9	42.0	45.3	39.3
+06 to +15	21.5	21.5	20.7	19.6	22.4	21.3	23.8
+16 to +25	4.7	4.0	4.9	5.3	3.4	4.0	6.5
+26 to +35	2.3	3.1	2.5	2.2	2.3	1.7	2.2
+36 to +45	1.2	1.0	1.7	0.5	1.0	0.9	2.0
+46 or greater	0.8	0.6	0.3	0.6	1.3	1.1	1.2
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	-	0.4	0.2	-	-
-24 to -15	2.5	1.5	3.2	3.6	2.5	2.3	1.7
-14 to -05	24.0	25.0	23.2	25.8	21.7	25.4	22.9
-04 to +05	44.2	45.6	40.7	45.1	47.2	43.5	43.9
+06 to +15	21.4	21.5	25.2	18.3	19.5	21.9	21.7
+16 to +25	5.0	5.0	5.1	4.1	5.6	3.9	6.1
+26 to +35	1.6	0.9	2.0	2.0	1.2	1.7	1.7
+36 to +45	0.7	0.1	0.6	0.1	0.9	1.1	1.6
+46 or greater	0.5	0.4	-	0.6	1.2	0.2	0.4

[1]American Standard, 1951.

Table 16. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the right ear at 8000 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Percentage distribution						
Both sexes							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.2	0.1	0.1	0.2	0.3	0.2	0.2
-24 to -15	6.2	5.1	4.3	6.2	8.0	6.4	6.9
-14 to -05	40.3	38.9	35.8	41.2	40.1	42.7	43.4
-04 to +05	36.6	33.2	43.5	35.8	36.5	36.6	33.6
+06 to +15	11.5	15.3	12.0	11.7	10.0	9.0	10.5
+16 to +25	3.2	4.8	2.1	3.6	3.5	2.6	2.9
+26 to +35	1.3	1.4	1.7	1.2	0.9	1.3	1.3
+36 to +45	0.3	0.5	0.2	0.1	0.2	0.4	0.6
+46 or greater	0.4	0.7	0.3	-	0.5	0.8	0.6
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.2	-	0.1	0.3	0.3	0.2	0.2
-24 to -15	5.7	4.0	4.5	4.1	8.9	6.0	6.7
-14 to -05	40.3	37.6	38.8	41.4	40.9	42.1	41.6
-04 to +05	35.9	35.5	37.9	34.4	35.9	36.1	35.2
+06 to +15	12.0	14.9	13.5	13.5	8.7	9.4	11.5
+16 to +25	3.6	4.8	3.1	4.8	3.6	3.0	2.5
+26 to +35	1.3	1.6	1.7	1.5	0.6	1.5	0.9
+36 to +45	0.4	0.9	-	-	0.5	0.5	0.8
+46 or greater	0.6	0.7	0.4	-	0.6	1.2	0.6
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.2	0.2	-	0.2	0.1	0.3	0.2
-24 to -15	6.6	6.3	4.2	8.5	7.1	6.7	7.2
-14 to -05	40.2	40.2	32.7	41.0	39.4	43.3	45.0
-04 to +05	37.3	30.7	49.3	37.2	37.1	37.1	32.0
+06 to +15	10.9	15.8	10.4	9.8	11.2	8.6	9.4
+16 to +25	2.9	4.8	1.1	2.4	3.5	2.2	3.4
+26 to +35	1.3	1.3	1.8	0.8	1.2	1.0	1.6
+36 to +45	0.2	0.1	0.4	0.1	-	0.3	0.5
+46 or greater	0.4	0.6	0.1	-	0.4	0.5	0.7

[1]American Standard, 1951.

Table 17. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the left ear at 8000 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Percentage distribution						
Both sexes							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.2	-	-	0.5	0.1	0.3	0.1
-24 to -15	6.7	3.2	6.2	7.3	8.2	6.7	8.7
-14 to -05	38.7	33.7	35.2	41.3	40.1	42.9	39.7
-04 to +05	38.6	46.4	43.6	35.3	36.8	34.2	34.9
+06 to +15	10.7	10.6	10.7	10.9	9.7	11.5	11.0
+16 to +25	2.9	4.1	2.7	2.5	2.8	2.2	3.2
+26 to +35	1.1	0.7	0.9	1.5	1.4	0.9	1.2
+36 to +45	0.7	0.7	0.6	0.4	0.4	0.9	0.9
+46 and greater	0.4	0.6	0.1	0.3	0.5	0.4	0.3
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	-	0.3	-	0.2	-
-24 to -15	6.6	4.2	5.1	6.2	8.5	7.2	8.5
-14 to -05	37.2	29.8	35.9	37.9	38.4	43.7	38.5
-04 to +05	38.7	46.0	43.4	36.5	37.9	32.6	34.9
+06 to +15	12.0	13.6	10.9	14.5	9.8	11.7	11.7
+16 to +25	3.1	4.6	2.6	3.4	3.2	2.2	2.6
+26 to +35	1.2	0.9	1.2	0.7	1.4	1.0	1.9
+36 to +45	0.6	0.2	0.7	0.5	0.2	0.7	1.5
+46 and greater	0.5	0.7	0.2	-	0.6	0.7	0.4
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.2	-	-	0.7	0.1	0.4	0.3
-24 to -15	6.8	2.2	7.3	8.4	7.9	6.2	9.0
-14 to -05	40.3	37.7	[illegible]4	44.9	42.0	41.9	40.7
-04 to +05	38.6	46.7	44.0	34.0	35.6	36.0	34.8
+06 to +15	9.4	7.7	10.5	7.3	9.5	11.3	10.2
+16 to +25	2.7	3.5	2.8	1.6	2.4	2.1	3.9
+26 to +35	1.0	0.5	0.5	2.2	1.5	0.8	0.5
+36 to +45	0.7	1.2	0.5	0.3	0.6	1.1	0.3
+46 and greater	0.3	0.5	-	0.6	0.4	0.2	0.3

[1]American Standard, 1951.

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Table 18. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the better ear at 250 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
Both sexes	Percentage distribution						
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.3	0.1	0.1	0.7	0.2	0.4	0.1
-24 to -15	15.4	7.7	9.5	15.8	17.1	20.9	20.9
-14 to -05	66.1	64.3	67.3	66.4	65.6	67.0	66.6
-04 to +05	16.1	24.7	21.0	14.8	14.9	9.9	10.9
+06 to +15	1.8	2.7	1.9	1.9	1.6	1.5	1.2
+16 to +25	0.3	0.5	0.2	0.3	0.4	0.3	0.3
+26 to +35	-	-	-	0.1	0.2	-	-
+36 or greater	-	-	-	-	-	-	-
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.2	0.3	-	0.2	0.2	0.5	0.1
-24 to -15	16.8	8.4	11.0	16.7	19.5	22.1	23.8
-14 to -05	66.3	64.0	67.9	66.2	65.3	67.3	67.5
-04 to +05	14.8	24.6	19.4	14.3	13.6	8.9	7.2
+06 to +15	1.4	1.8	1.2	2.1	1.1	1.2	0.9
+16 to +25	0.5	0.9	0.5	0.5	0.3	-	0.5
+26 to +35	-	-	-	-	-	-	-
+36 or greater	-	-	-	-	-	-	-
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.4	-	0.1	1.3	0.3	0.3	0.1
-24 to -15	13.9	6.9	8.0	14.9	14.6	19.7	20.4
-14 to -05	65.8	64.6	66.5	66.7	66.0	66.7	64.2
-04 to +05	17.4	24.7	22.8	15.2	16.2	11.0	14.0
+06 to +15	2.2	3.6	2.6	1.7	2.1	1.8	1.3
+16 to +25	0.2	0.2	-	0.1	0.5	0.5	-
+26 to +35	0.1	-	-	0.1	0.3	-	-
+36 or greater	-	-	-	-	-	-	-

[1] American Standard, 1951.

Table 19. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the better ear at 500 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Percentage distribution						
Both sexes							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.6	0.3	0.5	1.3	0.4	0.5	0.3
-24 to -15	13.8	7.5	8.0	14.1	15.0	19.3	18.9
-14 to -05	63.4	60.8	62.6	61.9	64.4	64.5	66.8
-04 to +05	19.9	29.2	26.1	19.2	17.5	14.7	11.8
+06 to +15	1.8	1.7	2.5	2.6	1.9	0.6	1.5
+16 to +25	0.5	0.5	0.3	0.8	0.6	0.4	0.6
+26 to +35	-	-	-	0.1	0.2	-	-
+36 or greater	-	-	-	-	-	-	0.1
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.3	0.4	0.7	0.1	0.4	0.2	-
-24 to -15	13.8	8.2	6.9	14.1	15.5	18.2	20.8
-14 to -05	62.9	58.6	62.3	59.8	65.3	65.4	66.4
-04 to +05	20.5	29.7	27.0	21.9	16.8	15.7	11.0
+06 to +15	1.8	2.1	2.6	2.9	1.7	0.3	1.3
+16 to +25	0.6	1.0	0.5	1.0	0.3	0.2	0.5
+26 to +35	0.1	-	-	0.2	-	-	-
+36 or greater	-	-	-	-	-	-	-
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.8	0.1	0.2	2.4	0.5	0.8	0.7
-24 to -15	13.8	6.8	9.1	14.1	14.5	20.5	18.3
-14 to -05	63.8	63.1	62.9	64.0	63.3	63.6	66.1
-04 to +05	19.3	28.7	25.3	16.5	18.3	13.6	12.5
+06 to +15	1.8	1.3	2.3	2.4	2.2	1.0	1.7
+16 to +25	0.4	-	0.2	0.6	0.9	0.5	0.5
+26 to +35	0.1	-	-	-	0.3	-	-
+36 or greater	0.0	-	-	-	-	-	0.2

[1]American Standard, 1951.

Table 20. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the better ear at 1000 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Percentage distribution						
Both sexes							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	0.1	0.1	0.1	0.1	0.1	-
-24 to -15	9.8	6.2	7.5	8.8	11.4	12.9	11.9
-14 to -05	63.2	60.7	60.2	63.2	62.3	65.3	68.4
+06 to +15	23.5	28.9	28.0	23.8	23.0	19.5	16.9
+16 to +25	2.6	3.6	3.1	3.2	2.0	1.7	2.3
+26 to +35	0.5	0.5	0.7	0.4	0.8	0.2	0.2
+36 or greater	0.2	-	0.4	0.3	0.2	0.2	0.2
	0.1	-	-	0.2	0.2	0.1	0.1
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.0	-	-	-	-	0.2	-
-24 to -15	9.1	5.6	7.7	8.0	11.9	11.0	10.9
-14 to -05	63.2	61.0	57.7	61.5	64.1	65.0	70.2
+06 to +15	23.9	28.3	29.9	25.9	20.8	21.4	16.4
+16 to +25	3.0	4.2	3.6	3.5	2.5	2.1	1.9
+26 to +35	0.4	0.9	0.3	0.4	0.6	-	0.2
+36 or greater	0.3	-	0.8	0.3	-	0.1	0.4
	0.1	-	-	0.4	0.1	0.2	-
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	0.2	0.1	0.1	0.3	-	-
-24 to -15	10.5	6.8	7.4	9.7	10.7	15.0	13.9
-14 to -05	63.2	60.4	62.8	64.9	60.5	65.6	65.5
+06 to +15	23.1	29.5	26.0	21.7	25.3	17.5	17.6
+16 to +25	2.4	2.9	2.6	2.9	1.6	1.2	2.9
+26 to +35	0.6	0.2	1.1	0.5	1.1	0.5	0.1
+36 or greater	0.1	-	-	0.2	0.3	0.2	-
	-	-	-	-	0.2	-	-

[1]American Standard, 1951.

Table 21. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the better ear at 2000 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Percentage distribution						
Both sexes							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.3	0.2	0.3	0.5	0.1	0.4	0.1
-24 to -15	14.1	10.8	10.7	14.7	15.8	17.3	15.9
-14 to -05	65.4	62.7	66.5	66.3	64.3	64.5	67.9
-04 to +05	18.2	24.5	21.0	16.3	17.2	16.5	13.7
+06 to +15	1.5	1.7	1.4	1.7	1.8	0.9	1.7
+16 to +25	0.3	0.1	0.1	0.4	0.4	0.3	0.2
+26 to +35	0.1	-	-	0.1	0.3	0.1	0.4
+36 or greater	0.1	-	-	-	0.1	-	0.1
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	-	0.2	0.1	0.4	0.1
-24 to -15	13.3	9.7	10.4	14.3	15.0	15.8	15.3
-14 to -05	65.1	61.7	66.5	65.9	65.2	65.2	66.2
-04 to +05	19.3	26.9	21.2	16.5	16.9	17.8	15.8
+06 to +15	1.7	1.5	1.7	2.4	2.2	0.6	1.8
+16 to +25	0.2	0.2	0.2	0.5	0.3	-	-
+26 to +35	0.2	-	-	0.2	0.3	0.2	0.4
+36 or greater	0.1	-	-	-	-	-	0.4
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.4	0.3	0.6	0.7	0.2	0.4	0.1
-24 to -15	14.9	11.9	11.1	15.1	16.5	18.8	16.1
-14 to -05	65.7	63.9	66.4	66.7	63.4	63.7	70.2
-04 to +05	17.2	22.0	20.9	16.1	17.5	15.2	11.3
+06 to +15	1.3	1.9	1.0	1.0	1.4	1.2	1.4
+16 to +25	0.3	-	-	0.4	0.4	0.7	0.5
+26 to +35	0.1	-	-	-	0.4	-	0.3
+36 or greater	0.1	-	-	-	0.2	-	0.1

[1]American Standard, 1951.

Table 22. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the better ear at 3000 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Percentage distribution						
Both sexes							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	0.1	0.1	-	0.2	0.2	0.1
-24 to -15	5.2	4.2	4.1	6.5	5.1	6.0	4.7
-14 to -05	47.6	46.1	44.1	46.7	47.9	51.0	50.6
-04 to +05	41.6	44.0	46.3	40.4	40.7	38.5	39.7
+06 to +15	4.6	5.0	4.8	5.6	5.2	3.4	3.4
+16 to +25	0.6	0.6	0.1	0.6	0.6	0.6	0.9
+26 to +35	0.2	-	0.5	-	0.2	0.1	0.3
+36 or greater	0.1	-	-	0.2	0.1	0.2	0.3
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	0.2	-	-	-	0.2	0.1
-24 to -15	4.8	3.0	4.4	5.8	5.4	5.8	4.7
-14 to -05	46.1	44.4	40.2	45.4	49.9	48.6	48.8
-04 to +05	42.7	45.2	48.4	41.7	38.9	40.2	41.4
+06 to +15	5.2	5.9	6.0	6.2	5.3	4.2	3.3
+16 to +25	0.6	1.3	-	0.6	0.2	0.6	0.7
+26 to +35	0.3	-	1.0	-	0.2	-	0.5
+36 or greater	0.2	-	-	0.3	0.1	0.4	0.5
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	0.1	-	0.5	0.2	-
-24 to -15	5.5	5.4	3.8	7.3	4.9	6.1	5.6
-14 to -05	49.1	47.7	48.2	48.1	45.7	53.4	51.9
-04 to +05	40.5	42.8	44.1	39.0	42.4	36.9	37.6
+06 to +15	4.0	4.1	3.6	4.9	5.1	2.6	3.6
+16 to +25	0.6	-	0.2	0.6	1.0	0.6	1.1
+26 to +35	0.1	-	-	-	0.2	0.2	-
+36 or greater	0.1	-	-	0.1	0.2	-	0.2

[1]American Standard, 1951.

Table 23. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the better ear at 4000 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Percentage distribution						
Both sexes							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	-	0.2	0.1	0.1	0.3
-24 to -15	4.2	3.6	3.3	4.9	4.7	4.7	3.5
-14 to -05	48.1	42.6	45.5	48.8	48.7	51.5	52.6
-04 to +05	41.0	45.9	44.6	40.6	39.8	38.6	35.6
+06 to +15	5.4	7.1	5.2	4.7	5.0	4.3	6.3
+16 to +25	0.7	0.6	0.9	0.7	1.1	0.2	0.8
+26 to +35	0.3	0.2	0.4	0.1	0.3	0.2	0.2
+36 or greater	0.2	-	0.1	-	0.3	0.4	0.7
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.0	-	-	-	-	0.2	-
-24 to -15	3.7	3.0	1.5	4.8	4.8	5.2	3.3
-14 to -05	48.1	40.8	46.5	48.7	51.3	48.5	53.7
-04 to +05	40.7	47.5	44.4	40.1	36.9	39.2	35.2
+06 to +15	6.1	7.4	6.0	5.2	5.7	6.2	6.0
+16 to +25	0.7	0.8	0.8	1.1	0.7	-	0.6
+26 to +35	0.3	0.5	0.6	0.1	0.3	0.4	-
+36 or greater	0.4	-	0.2	-	0.3	0.3	1.2
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.2	-	-	0.3	0.2	-	0.6
-24 to -15	4.6	4.2	5.1	5.0	4.7	4.3	4.4
-14 to -05	48.1	44.4	44.4	48.9	46.1	54.7	50.8
-04 to +05	41.3	44.3	44.9	41.2	42.8	38.0	38.3
+06 to +15	4.7	6.8	4.5	4.2	4.6	2.2	6.3
+16 to +25	0.7	0.3	0.9	0.3	1.4	0.4	0.8
+26 to +35	0.2	-	0.2	0.1	0.2	-	0.6
+36 or greater	0.2	-	-	-	0.2	0.4	0.2

[1]American Standard, 1951.

Table 24. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the better ear at 6000 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Percentage distribution						
Both sexes							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	-	0.2	0.1	0.2	0.1
-24 to -15	4.2	1.7	3.7	5.1	4.6	5.3	4.3
-14 to -05	36.6	36.0	33.9	38.6	38.5	36.7	35.8
-04 to +05	44.4	46.5	46.8	44.1	41.9	44.5	43.5
+06 to +15	12.1	13.3	13.1	10.1	11.9	10.9	13.6
+16 to +25	1.7	1.8	1.9	1.2	1.6	1.6	1.8
+26 to +35	0.5	0.6	0.4	0.4	0.7	0.5	0.4
+36 or greater	0.4	0.1	0.2	0.3	0.7	0.3	0.5
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.0	-	-	-	-	0.2	0.1
-24 to -15	3.9	1.6	2.7	4.1	4.8	5.6	4.8
-14 to -05	36.3	35.2	34.7	38.9	39.5	34.1	35.7
-04 to +05	44.1	45.1	47.0	43.4	39.7	46.9	42.3
+06 to +15	12.5	15.0	12.7	11.2	12.5	10.1	13.7
+16 to +25	1.9	2.2	1.6	1.4	1.9	2.2	1.8
+26 to +35	0.7	0.7	0.8	0.6	0.9	0.4	0.5
+36 or greater	0.6	0.2	0.5	0.4	0.7	0.5	1.1
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	-	0.4	0.2	0.1	-
-24 to -15	4.5	1.8	4.8	6.2	4.3	5.1	4.6
-14 to -05	36.9	36.9	33.1	38.3	37.4	39.5	36.5
-04 to +05	44.9	48.0	46.6	44.8	44.1	42.1	43.3
+06 to +15	11.7	11.5	13.4	9.1	11.3	11.7	13.0
+16 to +25	1.5	1.3	2.1	1.0	1.4	1.0	2.1
+26 to +35	0.3	0.3	-	0.1	0.6	0.3	0.4
+36 or greater	0.1	-	-	0.1	0.7	-	0.1

[1]American Standard, 1951.

Table 25. Percentage distribution of children, 6-11 years, by hearing levels in decibels re audiometric zero[1] for the better ear at 8000 cycles per second according to age and sex: United States, 1963-65

Sex and hearing levels in decibels	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Percentage distribution						
Both sexes							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.3	0.1	0.1	0.6	0.3	0.3	0.3
-24 to -15	10.5	7.5	8.9	11.0	13.3	10.1	12.3
-14 to -05	50.5	46.8	47.7	52.3	50.2	54.6	52.3
-04 to +05	30.7	35.1	36.2	27.5	28.5	28.5	27.2
+06 to +15	5.9	7.1	5.2	7.5	5.3	4.7	6.1
+16 to +25	1.5	2.5	1.3	0.9	1.8	1.1	1.1
+26 to +35	0.3	0.7	0.4	0.2	0.1	0.1	0.1
+36 or greater	0.3	0.2	0.2	-	0.5	0.6	0.6
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.2	-	0.1	0.6	0.3	0.2	0.1
-24 to -15	10.0	7.2	8.7	8.7	13.5	10.2	12.0
-14 to -05	49.5	41.6	48.8	52.1	49.8	54.1	50.7
-04 to +05	31.4	39.1	34.3	28.3	29.7	28.1	28.3
+06 to +15	6.8	9.1	6.6	8.9	3.9	5.2	6.8
+16 to +25	1.2	1.7	0.3	1.3	2.0	1.1	1.0
+26 to +35	0.4	0.9	0.8	0.1	0.2	0.1	0.2
+36 or greater	0.5	0.4	0.4	-	0.6	1.0	0.9
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.3	0.2	-	0.7	0.3	0.4	0.4
-24 to -15	11.0	7.8	9.0	13.4	13.1	10.0	13.0
-14 to -05	51.6	52.2	46.7	52.6	50.5	55.1	52.5
-04 to +05	30.0	31.0	38.1	26.6	27.3	28.9	27.4
+06 to +15	5.1	5.0	3.8	6.0	6.7	4.2	5.0
+16 to +25	1.8	3.3	2.4	0.5	1.7	1.1	1.4
+26 to +35	0.1	0.3	-	0.2	-	-	-
+36 or greater	0.1	-	-	-	0.4	0.3	0.3

[1] American Standard, 1951.

Table 26. Number and percentage distribution of children, 6-11 years, by hearing levels for speech (average of levels at 500, 1000, and 2000 cycles per second) in the better ear according to age and sex: United States, 1963-65

Sex and hearing levels in decibels re audiometric zero[1]	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Number of children in thousands						
Boys							
All levels	12,081	2,082	2,074	2,026	2,012	1,963	1,924
-25 or less	8	-	4	-	-	4	-
-24 to -15	1,025	93	128	170	203	208	223
-14 to -05	8,423	1,394	1,360	1,410	1,438	1,413	1,408
-04 to +05	2,393	541	546	381	337	322	266
+06 to +15	164	49	19	48	18	12	18
+16 to +25	51	5	17	13	16	-	-
+26 to +35	17	-	-	4	-	4	9
+36 or greater	-	-	-	-	-	-	-
Girls							
All levels	11,703	2,016	2,010	1,960	1,945	1,904	1,868
-25 or less	15	-	2	3	3	2	5
-24 to -15	1,138	123	144	195	181	276	219
-14 to -05	8,303	1,374	1,368	1,426	1,397	1,386	1,352
-04 to +05	2,066	501	466	298	319	224	258
+06 to +15	123	18	27	27	23	3	25
+16 to +25	51	-	3	11	15	13	9
+26 to +35	3	-	-	-	3	-	-
+36 or greater	4	-	-	-	4	-	-
	Percentage distribution						
Boys							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	0.2	-	-	0.2	-
-24 to -15	8.5	4.5	6.2	8.4	10.1	10.6	11.6
-14 to -05	69.7	66.9	65.5	69.6	71.5	72.0	73.2
-04 to +05	19.8	26.0	26.4	18.8	16.7	16.4	13.8
+06 to +15	1.4	2.4	0.9	2.3	0.9	0.6	0.9
+16 to +25	0.4	0.2	0.8	0.7	0.8	-	-
+26 to +35	0.1	-	-	0.2	-	0.2	0.5
+36 or greater	-	-	-	-	-	-	-
Girls							
All levels	100.0	100.0	100.0	100.0	100.0	100.0	100.0
-25 or less	0.1	-	0.1	0.2	0.1	0.1	0.3
-24 to -15	9.7	6.1	7.1	9.9	9.3	14.6	11.7
-14 to -05	71.0	68.2	68.0	72.8	71.8	72.8	72.4
-04 to +05	17.7	24.8	23.2	15.2	16.4	11.7	13.8
+06 to +15	1.1	0.9	1.4	1.4	1.2	0.1	1.4
+16 to +25	0.4	-	0.2	0.3	0.8	0.2	0.3
+26 to +35	0.0	-	-	-	0.2	-	-
+36 or greater	0.0	-	-	-	0.2	-	-

[1] American Standard, 1951.

Table 27. Median hearing levels in decibels re audiometric zero[1] for the right, left, and better ears of boys 6-11 years, at 250, 500, 1000, 2000, 3000, 4000, 6000, and 8000 cycles per second, by age: United States, 1963-65

Ear and tonal frequency	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Hearing levels						
Right ear							
250 cps	-8.7	-6.2	-7.3	-8.8	-9.6	-10.1	-10.7
500 cps	-7.8	-5.6	-6.4	-7.7	-8.5	-9.1	-9.8
1000 cps	-6.8	-5.5	-6.0	-6.3	-7.3	-7.7	-8.2
2000 cps	-7.6	-5.9	-7.4	-7.9	-8.2	-7.9	-8.4
3000 cps	-3.4	-2.4	-2.6	-3.5	-3.8	-4.1	-3.9
4000 cps	-3.3	-2.4	-2.7	-3.4	-4.1	-3.8	-4.2
6000 cps	-0.5	+0.1	+0.4	-0.6	-1.7	-0.4	-0.8
8000 cps	-4.1	-2.5	-3.3	-4.0	-5.0	-4.6	-4.7
Speech[2]	-7.3	-5.6	-6.4	-7.3	-7.8	-8.1	-8.6
Left Ear							
250 cps	-8.3	-6.1	-7.1	-8.2	-8.8	-9.6	-9.7
500 cps	-7.5	-5.6	-6.3	-7.6	-8.0	-8.5	-9.1
1000 cps	-6.5	-5.2	-5.5	-6.3	-7.2	-7.3	-7.7
2000 cps	-7.1	-6.2	-6.4	-7.2	-7.7	-7.6	-7.8
3000 cps	-3.1	-2.4	-2.3	-2.9	-3.6	-3.9	-3.3
4000 cps	-2.9	-2.0	-2.3	-2.8	-3.3	-3.4	-3.3
6000 cps	+0.6	+0.2	+0.5	+0.1	+0.5	+0.5	+1.4
8000 cps	-3.6	-1.8	-3.3	-3.7	-4.3	-5.2	-4.2
Speech[2]	-6.9	-5.7	-6.1	-6.7	-7.5	-7.6	-8.1
Better Ear							
250 cps	-10.2	-7.8	-8.7	-10.2	-11.1	-11.5	-11.9
500 cps	-9.2	-7.3	-7.6	-9.3	-10.0	-10.5	-11.2
1000 cps	-8.2	-7.0	-7.2	-7.8	-8.9	-9.2	-10.0
2000 cps	-9.3	-8.1	-8.8	-9.4	-10.1	-9.6	-9.9
3000 cps	-5.2	-4.6	-4.1	-5.2	-5.8	-5.7	-5.6
4000 cps	-5.3	-4.1	-4.7	-5.3	-5.9	-5.6	-6.0
6000 cps	-3.1	-2.6	-2.8	-3.5	-3.8	-3.0	-3.1
8000 cps	-6.7	-4.7	-6.4	-6.9	-7.6	-7.7	-7.2
Speech[2]	-8.8	-7.4	-7.6	-8.7	-9.7	-9.8	-10.4

[1] American Standard, 1951.

[2] Average of levels at 500, 1000, and 2000 cps.

Table 28. Median hearing levels in decibels re audiometric zero[1] for the right, left, and better ears of girls, 6-11 years, at 250, 500, 1000, 2000, 3000, 4000, 6000, and 8000 cycles per second, by age: United States, 1963-65

Ear and tonal frequency	Total, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Hearing levels						
Right ear							
250 cps	-7.9	-5.9	-6.8	-8.3	-7.9	-9.0	-9.9
500 cps	-7.7	-5.5	-6.6	-8.1	-7.6	-9.2	-9.3
1000 cps	-6.8	-5.4	-6.2	-6.8	-6.2	-8.1	-8.3
2000 cps	-7.7	-7.0	-7.0	-7.9	-7.9	-8.4	-8.3
3000 cps	-3.8	-3.7	-3.1	-4.0	-3.2	-4.5	-4.3
4000 cps	-3.5	-2.7	-3.4	-3.6	-3.3	-4.0	-3.8
6000 cps	-0.6	+0.1	+0.2	-1.2	-0.3	-1.7	-0.9
8000 cps	-4.3	-4.0	-2.6	-4.9	-4.2	-5.1	-5.4
Speech[2]	-7.3	-5.9	-6.7	-7.6	-7.3	-8.4	-8.5
Left ear							
250 cps	-7.6	-6.2	-6.7	-7.1	-7.6	-8.6	-8.9
500 cps	-7.6	-6.2	-6.5	-8.0	-7.6	-9.2	-8.9
1000 cps	-7.0	-5.6	-6.0	-7.2	-6.7	-8.2	-8.3
2000 cps	-7.7	-6.7	-6.9	-8.0	-7.9	-8.3	-8.8
3000 cps	-3.7	-2.9	-2.9	-4.1	-3.3	-4.2	-4.4
4000 cps	-3.0	-2.7	-2.4	-3.0	-2.7	-4.1	-2.9
6000 cps	-0.1	-0.3	+0.9	-1.2	+0.2	+0.2	+0.2
8000 cps	-4.4	-3.1	-3.6	-5.7	-5.0	-4.7	-5.0
Speech[2]	-7.3	-6.2	-6.3	-7.5	-7.4	-8.4	-8.5
Better ear							
250 cps	-9.5	-7.7	-8.3	-10.1	-9.6	-10.8	-11.2
500 cps	-9.3	-7.6	-8.0	-9.9	-9.4	-11.1	-10.8
1000 cps	-8.5	-7.2	-7.8	-8.6	-8.3	-9.8	-10.3
2000 cps	-9.7	-8.7	-8.8	-9.8	-10.1	-10.4	-10.5
3000 cps	-5.8	-5.5	-5.3	-5.9	-5.2	-6.4	-6.2
4000 cps	-5.5	-4.8	-4.9	-5.7	-5.2	-6.4	-5.9
6000 cps	-3.4	-3.0	-2.7	-4.0	-3.5	-4.0	-3.4
8000 cps	-7.1	-6.6	-5.9	-7.9	-7.4	-7.5	-7.8
Speech[2]	-8.1	-7.0	-7.0	-8.3	-8.2	-10.0	-10.7

[1] American Standard, 1951.

[2] Average of levels at 500, 1000, and 2000 cps.

APPENDIX I

RECORDING FORM

HEALTH EXAMINATION SURVEY—II

AUDIOMETRY

CARD 05

AUDIO.

'DIOMETER NO. (8-9) | EXAMINER (10-11)

USE THIS SECTION WHEN SAMPLE NO. IS EVEN	CARD COL. NOS.	USE THIS SECTION WHEN SAMPLE NO. IS ODD
CPS		CPS
4000: R ← L	(12-13)	4000: R → L
1000: R → L	(16-17)	1000: R ← L
6000: R ← L	(20-21)	6000: R → L
500: R → L	(24-25)	500: R ← L
2000: R ← L	(28-29)	2000: R → L
250: R → L	(32-33)	250: R ← L
4000: R ← L	(36-37)	4000: R → L
8000: R → L	(40-41)	8000: R ← L
3000: R ← L	(44-45)	3000: R → L

CONDITIONS AFFECTING TEST RESULTS (Check)

46 ☐ 1 None

☐ 2 Conditions affecting test results

☐ Cold at present ☐ Cold within past week

☐ Ear discharge ☐ Earache within past week

☐ Equipment defective* ☐ Behavior* ☐ Other*

*☐ Specify .....

APPENDIX II

STATISTICAL NOTES

The Survey Design

The sample design for the second cycle of the Health Examination Survey, similar to the one used for the first cycle, was that of a multistage, stratified probability sample of loose clusters of persons in land-based segments. Successive elements dealt with in the process of sampling are primary sampling unit (PSU), census enumeration district (ED), segment, household, eligible child (EC), and finally, the sample child (SC).

At the first stage, the nearly 2,000 PSU's into which the United States (including Hawaii and Alaska) had been divided and then grouped into 357 strata for use in the Current Population Survey and the Health Interview Survey were further grouped into 40 superstrata for use in Cycle II of the Health Examination Survey. The average size of each Cycle II stratum was 4.5 million persons and all fell between the limits of 3.5 and 5.5 million. Grouping into 40 strata was done in a way that maximized homogeneity of the PSU's included in each stratum, particularly with regard to degree of urbanization, geographic proximity, and degree of industrialization. The 40 strata were classified into four broad geographic regions (each with 10 strata) of approximately equal population and cross-classified into four broad population density groups (each having 10 strata). Each of the 16 cells contained either two or three strata. A single stratum might include only one PSU (or only part of a PSU as for example New York City which represented two strata) or several score PSU's.

To take account of the possible effect that the rate of population change between the 1950 and 1960 censuses might have had on health, the 10 strata within each region were further classified into four classes ranging from those with no increase to those with the greatest relative increase. Each such class contained either two or three strata.

One PSU was then selected from each of the 40 strata. A controlled selection technique was used in which the probability of selection of a particular PSU was proportional to its 1960 population. In the controlled selection an attempt was also made to maximize the spread of the PSU's among the States. While not every one of the 64 cells in the 4 x 4 x 4 grid contributes a PSU to the sample of 40 PSU's, the controlled selection technique ensured the sample's matching the marginal distributions in all three dimensions and being closely representative of all cross-classifications.

Generally, within a particular PSU, 20 ED's were selected with the probability of selection of a particular ED proportional to its population in the age group 5-9 years in the 1960 census, which by 1963 roughly approximated the population in the target age group Cycle II. A similar method was used for selecting one segment (cluster of households) in each ED. Each of the resultant 20 segments was either a bounded area or a cluster of households (or addresses). All of the children in the age range properly resident at the address visited were EC. Operational considerations made it necessary to reduce the number of prospective examinees at any one location to a maximum of 200. The EC to be excluded for this reason from the SC group were determined by systematic subsampling.

The total sample included 7,417 children in the 6-11 year age group with approximately 1,000 in each of the single years of age and from 25 different States.

Reliability

Measurement processes employed in the survey were highly standardized and closely controlled. Of course this does not mean that the correspondence between the real world and the survey results is exact. Data from the survey are imperfect for three major reasons: (1) results are subject to sampling error, (2) the actual conduct of a survey never agrees perfectly with the design, and (3) the measurement processes themselves are inexact even though standardized and controlled.

The first report on Cycle II [6] describes in detail the faithfulness with which the sampling design was carried out. It notes that out of the 7,417 sample children the 7,119 who were examined—a response rate of 96 percent—gave evidence that they were a highly representative sample of children of this age in the noninstitutional population of the United States. The

response levels for the various demographic subgroups—including those for age, sex, race, region, population density, parents' educational level, and family income—show no marked differentials. Hence, it appears unlikely that nonresponse could bias the findings much in these respects.

Measures used to control the quality of the data from this survey in general have been cited previously:[4] those relating specifically to the testing of hearing are outlined in an earlier section of this report.

Data recorded for each sample child are inflated in the estimation process to characterize the larger universe of which the sample child is representative. The weights used in this inflation process are a product of the reciprocal of the probability of selecting the child, an adjustment for nonresponse cases, and a poststratified ratio adjustment which increases precision by bringing survey results into closer alignment with known U.S. population figures by color and sex within single years of age 6-11.

In the second cycle of the Health Examination Survey the sample was the result of three stages of selection—the single PSU from each stratum, the 20 segments from each sample PSU, and the sample children from the eligible children. The probability of selecting an individual child is the product of the probabilities of selection at each stage.

Since the strata are roughly equal in population size and a nearly equal number of sample children were examined in each of the sample PSU's, the sample design is essentially self-weighting with respect to the target population, that is, each child 6-11 years old had about the same probability of being drawn into the sample.

The adjustment upward for nonresponse is intended to minimize the impact of nonresponse on final estimates by imputing to nonrespondents the characteristics of "similar" respondents. Here "similar" respondents were judged to be examined children in a sample PSU having the same age (in years) and sex as children not examined in that sample PSU.

The poststratified ratio adjustment used in the second cycle achieved most of the gains in precision which would have been attained if the sample had been drawn from a population stratified by age, color, and sex and makes the final sample estimates of population agree exactly with independent controls prepared by the Bureau of the Census for U.S. noninstitutional population as of August 1, 1964 (approximate midsurvey point) by color and sex for each single year of age 6 through 11. The weights of every responding sample child in each of the 24 age, color, and sex classes is adjusted upwards or downwards so that the weighted total within the class equals the independent population control.

In addition to children not examined at all, there were some whose examinations were incomplete in one procedure or another. During the hearing test, when it became apparent that the child was too fatigued to give reliable responses, the frequencies of 3000 and 8000 cycles per second were omitted. If the technician considered other parts of the test unreliable because he was unable to obtain cooperation of the child for other physical or mental reasons or the audiometer was not functioning properly, the test parts affected were also not used. The extent of missing data for the hearing tests is shown in table I.

Table I. Missing hearing test data, by age of examinee: Health Examination Survey, 1963-65

Hearing test missing	All examinees, 6-11 years	6 years	7 years	8 years	9 years	10 years	11 years
	Number of children						
All frequencies (number of children for whom one or more test parts are incomplete)	1,758	748	642	168	81	67	52
	Number of ears						
Test incomplete for frequencies of:							
250 cps	933	483	330	144	74	38	48
500 cps	797	377	289	111	47	42	31
1000 cps	272	147	60	33	7	11	13
2000 cps	439	445	225	129	61	31	48
3000 cps	3,334	1,350	1,181	276	134	73	36
4000 cps	103	63	23	9	2	4	2
6000 cps	347	269	119	42	24	28	17
8000 cps	3,463	1,348	1,180	271	111	73	38

For each of the examined children not given the hearing test, a respondent of the same age-sex-race group was selected at random and his test results assigned to the nonexamined person.

When only incomplete test results were available (1,758 children), a variety of methods were used, depending upon the extent of missing data. If only one ear was tested, it was assumed that the findings for the other ear would have been the same. If partial results were available, the levels reached by the other ear at the particular frequencies were used as the estimates if they were consistent with the audiogram for the ear on which data were missing. Otherwise, projections were made on the basis of the parts of the audiogram available. It is readily apparent from table I that the high proportion of missing data at 3000 and 8000 cycles for the 6- and 7-year-old children is so large that national estimates based on them for these two age groups would be extremely unreliable. These estimates, which nevertheless have been included to give an overall picture of the findings, should be considered with this limitation.

Sampling and Measurement Error

In the present report, reference has been made to efforts to minimize bias and variability of measurement techniques.

The probability design of the survey makes possible the calculation of sampling errors. The sampling error is used here to determine how imprecise the survey test results may be because they come from a sample rather than from the measurements of all elements in the universe.

The estimation of sampling errors for a study of the type of the Health Examination Survey is difficult for at least three reasons: (1) measurement error and "pure" sampling error are confounded in the data—it is not easy to find a procedure which will either completely include both or treat one or the other separately. (2) the survey design and estimation procedure are complex and accordingly require computationally involved techniques for the calculation of variances, and (3) from the survey are coming thousands of statistics, many of subclasses of the population for which there are a small number of cases. Estimates of sampling error are obtained from the sample data and are themselves subject to sampling error which may be large when the number of cases in a cell is small or even occasionally when the number of cases is substantial.

Estimates of approximate sampling variability for selected statistics used in this report are presented in table II. These estimates have been prepared by a replication technique which yields overall variability through observation of variability among random subsamples of the total sample. The method reflects both "pure" sampling variance and a part of the measurement variance.

In accordance with usual practice, the interval estimate for any statistic may be considered the range within one standard error of the tabulated statistic, with 68-percent confidence; or the range within two standard errors of the tabulated statistic, with 95-percent confidence. The latter is used as the level of significance in this report.

An overestimate of the standard error of a difference $d = x - y$ of two statistics x and y is given by the formula $S_d = (S_x^2 + S_y^2)^{1/2}$ where S_x and S_y are the sampling errors, respectively, of x and y, shown in table II.

Small Categories

In some tables magnitudes are shown for cells for which the sample size is so small that the sampling error may be several times as great as the statistic itself. Obviously in such instances the statistic has no meaning in itself except to indicate that the true quantity is small. Such numbers, if shown, have been included in the belief that they may help to convey an impression of the overall story of the table.

Table II. Standard error, expressed in percentage points, for percent of children with a specified hearing threshold level: United States, 1963-65

Age	Prevalence in percent			
	1 or 99	5 or 95	25 or 75	50
	Standard error in percentage points			
All ages, 6-11 years	0.1	0.4	1.1	1.2
6 years	0.4	0.8	1.3	2.0
7 years	0.4	0.9	1.3	2.0
8 years	0.4	0.8	2.0	2.0
9 years	0.3	0.9	2.0	2.0
10 years	0.3	1.0	2.0	2.0
11 years	0.3	1.1	2.0	2.0

APPENDIX III

STANDARDS FOR REFERENCE (AUDIOMETRIC) ZERO

The sound pressure standards for "normal" auditory threshold—the 1951 American Standards Association audiometric zero—maintained by the National Bureau of Standards were derived from data of the National Health Survey of 1935-36, as described previously. The original measurements were determinations of voltages applied at the terminals of the audiometer earphones used in the survey for a subgroup of persons with "normal" hearing. These threshold data were transferred by loudness balancing to a group of standard earphones designed especially for stability in calibration—the Western Electric 705-A. After loudness balancing, the earphones were placed on an NBS 9-A standard calibrating coupler and their response was measured.

Later, and in a similar fashion, the National Bureau of Standards transferred the threshold from the Western Electric 705-A earphone to five other types of earphones.

The threshold standards in terms of sound pressure in a standard coupler will be valid for the earphones of these types provided the earphone cushions are of controlled profile, thickness, and compliance; the distance from the front of the face of the moving diaphragm to the plane of the cushion is held constant; and that the earphone is held against the ear with a constant coupling force.[17,18] They will not apply to earphones of other types.

The transfer characteristics for the TDH-39 earphones with MX-41/AR cushions used in this survey were those suggested by Allison Laboratories.[19]

The new (1964) standard reference zero recommended by the International Organization for Standardization (ISO),[20-24] is now under consideration to replace the differing 1951 American and the 1954 British Standards.[25] The new standard has been accepted by the Committee on Conservation of Hearing of the American Academy of Ophthalmology and Otolaryngology and by the American Speech and Hearing Association for their own use. Since these new standards will be appearing in many of the journals and other technical publications starting January 1, 1965, the comparison of them with the 1951 American Standard on the 705-A earphones and the TDH-39 earphones used in this survey is shown in table III.

The thresholds for the 1951 American Standard and the recommended ISO Standard on the 705-A earphones are rounded to the nearest 0.5 dB in accordance with the ISO method of presentation. The TDH-39 thresholds are retained in the form used to convert the findings from this survey to decibels re 0.0002 dyne per square centimeter, as shown in the section "Comparison With Findings From Other Studies."

Table III. Comparison of 1951 American Standard and the recommended ISO Standard for reference zero

Frequency	1951 American Standard for reference zero of:		Recommended ISO Standard for reference zero of ME-705-A earphones[1]
	ME-705-A earphones[1]	TDH-39 earphones[1]	
	Decibels re 0.0002 dyne per square cm.		
250 cps	29.0	28.7	24.5
500 cps	25.0	24.4	11.0
1000 cps	16.5	17.4	6.5
2000 cps	17.0	19.1	8.5
3000 cps	[2]10.0	17.0	7.5
4000 cps	15.0	13.4	9.0
6000 cps	[2]17.5	23.0	8.0
8000 cps	20.0	21.4	9.5

[1]On NBS 9-A coupler. TDH-39 earphone reference values shown here are those of Allison Laboratories. The other two were determined by averaging many different determinations from many different countries, available from the National Bureau of Standards.

[2]Estimated.

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